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Electrical Material Prices.

THE past year has been a not uneventful one for the copper industry, and if it has illustrated anything it must be the failure of the attempt on the part of the leading interests to stabilise the price. They endeavoured to fix it at too high a level, and the subsequent break in quotations brought the value of electrolytic copper at one time to little more than half what it was at the close of 1929. General circumstances, of course, were the reverse of propitious for the maintenance of values, as the copper-consuming industries did not escape the effects of the general world depression, which has reflected itself in industrial conditions in the United States, Germany, and other leading consuming countries. This is illustrated by the fact that during the first eleven months of 1930 (the latest data available at the time of writing) the total American deliveries of refined copper to domestic and overseas buyers amounted to 1,154,492 short tons, compared with 1,612,201 tons during January/November, 1929, whilst from the close of that year till the end of November, 1930, the American stocks of refined copper had increased by no less than 198,500 tons. It was obvious from this that although production had declined somewhat, the diminution had been insufficient to offset the drop in consumption, and towards the close of the year a conference of leading producers was held in New York, when it was resolved to put a further reduction into effect, provided no legal objection to such an agreement was raised by the United States Government. Meanwhile, the price of electrolytic copper had dropped from about £83 to about £45 per ton, but at the lower level consumers showed more disposition to lay in stocks, an inclination which was accentuated by reports of a probable further cut in output. As a consequence, values rallied from the lowest, but with the continued depression in trade, and the big stocks of copper on hand in America, there hardly seems justification for much further recovery in prices just yet.

Lead, too, has not been unaffected by the acute industrial depression affecting most industries during 1930, but in many ways it has suffered less than other non-ferrous metals. Prices, although much below what they were at the beginning of last year, are only down

to pre-war prices, but the collapse of the silver market has hit lead producers fairly hard. Production has not been curtailed very markedly, outside the United States, which, being a self-contained market, has not affected the European situation much. In the first half of the year Russia bought substantial quantities, but this did little more than offset the very marked decline in the German takings, whilst at home consumption has undoubtedly fallen off. The building trade maintained quite a high rate of activity, as did also the battery trade, but cable-makers bought appreciably less lead than in 1929, whilst corroders experienced but a poor demand throughout the year. The high costs of labour and low prices of metals have rendered profitable production difficult in Australia, and the year closes with the outlook in that direction rather uncertain, owners and men having difficulty in agreeing thus far upon the terms of a new wages contract. The Lead Producers' Association has not forcibly intruded itself, but by keeping surplus supplies off the market and holding them with a strong hand, it has tended to mitigate the effects of a deteriorating statistical position. The immediate outlook for 1931 is drab, supplies being in excess of demand, and, unless serious labour troubles develop in Australia, higher prices seem a long way off, for even if current production is curtailed, the Mount Isa property, in Queensland, promises to add considerable quantities of lead to the world's supplies during 1931.

The past year has been one of marked depression in the rubber industry. Prices fell consistently from about 8d. per lb. at the beginning of the year to easily the lowest figure ever recorded at the end of September. Early in the year British and Dutch interests got together to evolve some method for the regulation of supplies, the result of their deliberations taking the form of a month's holiday from tapping during May. This, however, did not materially improve the statistical position, for although European-owned estates supported the scheme, native producers did not co-operate very wholeheartedly. Subsequent efforts by British and Dutch planters to secure Government support for a scheme to restrict exports to 75 per cent. of the 1929 figure failed, the Malayan and Dutch East Indies Governments stating that the native production was an insuperable bar to successful Government intervention. Despite the tapping holiday in May, the Malayan shipments last year nearly equalled those of 1929, when stocks (which had accumulated during the Stevenson restriction scheme) were being liquidated. The shipments from the Dutch East Indies declined somewhat in the second half of the year, but consumption throughout the world, and particularly in the United States (the biggest consuming country), fell away seriously, with the result that the world stocks of raw rubber are estimated to have increased by about 130,000 tons during 1930. In this country, about 58,000 tons was added to the stocks in the past twelve months, whilst in America the increase at the end of November totalled nearly 70,000 tons. At current prices many producing companies are reducing output, and raw rubber is replacing reclaimed. These factors should tend to improve the position, but it may be some appreciable time before the rubber industry is free from its present difficulties.

The Portishead Fire.

IT is pleasing to note that the effects of the fire at the Portishead power station of the Bristol Corporation on Christmas Eve, which was reported by us last week, with an illustration of the turbine room after the event, have proved less disastrous than was at first feared. The fire was restricted to a portion of the roof of the turbine house. The boiler house, transformer house, switch houses, and the administration block of buildings fortunately escaped damage.

The 20,000-kW set on which the trouble originated was, of course, partly wrecked, but the other 20,000-kW set and the more recently installed 50,000-kW set received only minor injuries due to material falling from the roof and to salt water from the firemen's hose-pipes; the consequential results of the later will doubtless cause some anxiety to MR. H. FARADAY PROCTOR and his staff until its limitations have been tested under operating conditions. The latest information available, however, shows that the 50,000-kW set, which was re-started early in the afternoon of the Sunday following the fire, has shown no signs of distress, and appears to be none the worse in any way for its rough usage. Two points for consideration emerge from the event. The first is that, owing to supply being available from another interconnected source, the failure due to an occurrence that is unprecedented was of less than half-an-hour's duration, albeit owing to the season of the year it was rendered more conspicuous than it would otherwise have been. The other point is that a capital station after a mishap of such magnitude was put into service within a few days; this indicates that the risks incurred in concentrating plant in "super stations" are only of the same order as those for relatively small stations, which are, moreover, less likely to be interconnected with others. Doubtless the experience gained at Portishead will make the possibility of a repetition of an accident of this kind anywhere even more remote than it is under present conditions.

The Shannon Scheme.

THE progress made to date by the Irish Free State Electricity Supply Board represents a remarkable achievement. Our correspondent in Ireland, MR. R. N. TWEEDY, shows in his article, a further instalment of which is published this week, that the output from the Ardnacrusha hydro-electric power station is considerably more than 12 months in advance of the programme, that few villages of more than 500 inhabitants are without supplies, and that the sales of domestic appliances during the 14 months which have elapsed since it was started promised well for the practical interest of consumers in the scheme. With regard to rumours that the original estimate of the capital cost of the power station had been exceeded, it now appears that the excess of the actual over the estimated cost of the work originally covered was less than 5 per cent. One feature of the scheme which we believe to be unique is the rate of 0.5d. per kWh for electricity supplied for water heating throughout the country. In respect of uniformity of tariff the advantage is likely to remain with Ireland for some time, since one authority there operates over the whole area of supply. In this the Supply Board is not quite the counterpart of the Central Electricity Board, which, of course, controls generation only.

Mr. Tweedy twits those who were sceptical as to the possibility of fulfilment of the anticipations on which the original proposals were based. Of the sincerity of the doubters in many cases we are quite sure, just as sure as we feel that they would be only too glad to be proved wrong in the ultimate event.

Among the unbelievers there were also those who feared that a scheme of this nature was foredoomed to be the toy of political interests. This fear has proved to be unfounded. How petty do such interests appear in the light of the magnanimous statement of DR. T. A. MCLAUGHLIN at the opening meeting of the I.E.E. Irish Centre which was reported in our issue of November 7th! The managing director of the Supply Board, it will be remembered, said that his one ambition was to see the interconnection of the Belfast steam plant with the Shannon hydro-electric system. This would be sound technically, but its implications are even more far-reaching. The subject is too deep for discussion here, but it provides an indication of the logic of the facts of applied science and modern industry, to which we may look more hopefully than to political elements for the world's safety and progress.

Central Board Contracts.

AN acceptable New Year gift to the electrical industry was announced by the Central Electricity Board on January 1st in the shape of orders for equipment for a number of its schemes to the value of £2,000,000; since these, two further contracts worth £270,000 have been placed. These bring up the total value of orders placed by the Board since it commenced active operations in 1927 to about £14,500,000. Thus the makers of overhead lines, cables, transformers, switchgear, &c., have received considerable benefit from the operation of the Act of 1926, assuming, of course, that the contracts have carried a fair rate of profit.

If the anticipated improvements in electricity supply materialise and energy is rendered more generally available at lower rates, the manufacturers of current-consuming devices, both of an industrial and a domestic character, will next derive benefit from the Board's work.

Ultimately the whole of British industry will feel the rejuvenating effects of electrification, as suggested by SIR HUGO HIRST at the B.E.A.M.A. dinner in November last. Although these developments will probably mean some alteration in the structure of the electrical manufacturing industry, the industry is in a strong position and has an assured future.

Progress in Country Towns.

IN dealing in the past, in our Electricity for the Home section, chiefly with the larger supply undertakings in the country, it has not been our intention to imply that such concerns are the only ones that have made headway, and in support of this we turn our attention in this issue to small undertakings in country towns, more or less isolated. Electricity supply in the country districts is becoming more and more important, and in view of the schemes that are at present being designed and launched for rural electrification this is an opportune moment for taking note of what is being done by, and giving encouragement to, the country-town supply engineer, who is usually handicapped by lack of financial resources, showrooms, and so on. We have selected as our examples Ashford, Kent, and Bury St. Edmunds, Suffolk, and it is particularly interesting to note that when we approached the supply engineers of the towns in question, MR. H. WILSON, of Ashford, and MR. E. A. KNIGHTS, of Bury St. Edmunds, both replied to the effect that they thought that their accounts would make a poor showing against those that had already been published in this section. That in itself suggests a feeling of diffidence that probably exists among the engineers of small undertakings, which should certainly not be allowed to prevail, especially when it is noted that, by percentages, the smaller undertaking can sometimes put up a better showing than the larger one.

Change-overs and Radio.

THE writer of a letter published in our "Correspondence" columns this week alleges that some supply undertakings with d.c. systems are discouraging the use of mains-operated radio sets by suggesting that free replacements of the requisite components of such apparatus will not be made when a change-over to a.c. takes place.

We must sympathise with a distributing authority which fears the possibility of having to face an unknown liability for which a reasonable allowance for contingencies based on previous experience may prove altogether insufficient, since it is impossible in practice to ensure that consumers shall report all small current consuming additions to their installations. We cannot, however, admit that the attitude which is said to be adopted has any justification, except as a temporary measure during the planning and carrying out of a change-over. The legal position was dealt with in an article entitled "Change-overs and Replacements" which appeared in our issue of August 8th last, and its general aspects in our leading article of the same date.

Apart from the problems arising out of a change of system, there is also some uncertainty as a result of suggestions that the present voltage variation limits of plus or minus four per cent. should be extended. This aspect of the situation was commented on in our issue of October 31st, when we drew attention to the views on voltage limits expressed by MR. C. C. PATERSON in his presidential address to the I.E.E. The tendency is for apparatus to be produced with an ever-decreasing deviation from uniformity, and any step to reverse this tendency in the interests of electricity supply undertakings should take fully into account the interests of the other two parties concerned—the consumers and the manufacturers—since so much electrical apparatus is dependent for its effectiveness and life on a constant voltage. The need for any relaxation in the present regulations, apart from the latitude which is quite obviously tolerated in difficult cases, should be based upon data which, so far as we are aware, has not been collated on a scale commensurate with what such a change may involve.

An Important Power Merger.

LAST week we reported that an agreement had been arrived at for the acquisition by the Shropshire, Worcestershire and Staffordshire Electric Power Co., Ltd., of the South Wales Electric Power Distribution Co. The acquisition involves the sum of £1,250,000. The S.W. & S. Company already operates in seven counties, comprising an area of 2,500 square miles, and the addition of the South Wales area will make the area of supply one of the largest, if not the largest, under the control of any single undertaking in the country.

It was stated last week by MR. J. T. H. LEGGE, managing director of the S.W. & S. Company, that the distribution network of South Wales would shortly be interconnected with that of the Midlands, and when that was done the supply would be continuous from Smethwick, Oldbury, and Dudley in the north, through Worcestershire, Herefordshire, Monmouthshire, and Glamorganshire, to the south-west coast. Mr. Legge states that the merger, which will mean intensive development of the distribution systems with an increase in employment, is evidence of a policy of rationalisation.

The South Scotland Scheme.

THE South Scotland Electricity Scheme, 1930, prepared by the Electricity Commissioners, was released for publication on Wednesday of this week (H.M. Stationery Office, 1s. 6d. net; Supplementary Particulars, 3s. 6d. net). The area has a population of only 59 persons per square mile, but it is important as a generating centre since it contains appreciable water-power resources; five water-power stations have been selected for operation. We propose to deal more fully with this scheme in our next issue.

Electricians' Wages.

IN this issue a correspondent writing under the pen-name "Hadsum" invites editorial comment upon the recent increase in wages in the electrical contracting industry resulting from a revision of the methods of calculating these wages (*vide* ELEC. REV., November 14th, p. 820).

The only comment which we can fairly make is that the matter was settled by accredited representatives of both parties. The National Federated Electrical Association is closely allied to the Electrical Contractors' Association, the only national contractors' organisation, while the Electrical Trades Union is vested with equal authority on behalf of the employés.

Harmonious relations between the two bodies have been preserved for a long period, and we think that it would be unwise to disturb them. We doubt, too, whether a better method of settling wages could be found. At least the new arrangement gives a stable rate for a period of twelve months instead of four months; this is of value to contractors when tendering.

Gamage's New Building.

Notes on the Electrical Features, with Particular Reference to the Lighting.

(*Concluded from page* 9.)

In a series of model rooms on the lower ground floor systems of home electrical illumination are demonstrated to good advantage, while in the electrical section a wide range of domestic appliances of all descriptions are shown, including cookers, grillers, fires, lighting fittings, etc. This section demonstrates the uses of electric lighting for display purposes more completely, perhaps, than does any other section. Showcases of all shapes and dimensions are effectively illuminated by means of "Striplite" lamps, concealed from sight by specially-designed aluminium striplighting reflectors, fig. 9.

Fig. 8.—Artificial Lighting of a Main Bay on Ground Floor.

The illumination of the whole of the main (ground) floor is along efficient lines. In all, there are some 120 two-tier special opalescent glazed pendants, with bronze-colour art-metal work of pleasing design, fig. 8. Each unit has a 4-point corded silk suspension to harmonise with the general surroundings, and is equipped with 500-watt gasfilled lamps. The lighting has been designed on the basis of 1.5 watts per square foot, without the aid of local or showcase lighting. In the other sections of the store the lighting has been figured out on the basis of half a watt less. Mention must be made here of the artistic form of lighting that has been evolved for the popular soda fountain, fig. 10. This consists in the main of a large wired plate-glass form of suspended daylight, 8 ft. by 4 ft., glazed with special amber diffusing glass, and a system of cove lighting in the background, equipped with 25-watt "Pearl" lamps at 3¼ in. centres on a continuous run of reflector. In the adjacent quick-luncheon buffet, fig. 11, the lighting is by half-spherical demi-coupe wall brackets, equipped with 40-watt lamps, running the whole length of each side of the restaurant.

On the first floor the lighting is carried out on striking and ambitious lines, for again there are some 120 modern lighting pendants of superb design and workmanship, utilising 300-W lamps. These are of square formation, and embrace special opalescent glassware and art metal-work of bronze finish, with short corded 4-point suspensions. The second-floor main lighting is by 16-in. diameter "Superlux" pendants, glazed with low-absorption glassware, with frosted silver-finished art-metal work. The third floor is lighted in a similar manner by these pendants, and here again it is necessary to stress the effective way in which "Striplite" lamps are employed for the lighting of the various showcases.

In the restaurant on the fourth floor hidden striplighting again excites the admiration of the visitor. This is concealed along some 1,300 ft. of cornice reflector, enamelled stone colour and glazed, and equipped with 30-W lamps, fig. 12. Every window, with its canary net curtains, is transformed into a golden picture of gossamer-like character by the same concealed system of striplighting, but perhaps more artfully applied, fig. 13.

The illuminated alcoves or the plate-glass pendants on landings and ceilings still speak of light, as also do the lifts, with their sun-bathed interiors and their signalling devices. There are twenty-eight "Express" electric lifts, all of the most modern design, in this building. A battery of fifteen lifts is arranged at the back of the store facing the main entrance. Four passenger and four trades lifts serve residential flats on the

Fig. 9.—Illuminated China-display Cabinets.

upper floors. A large lift is provided in the staff staircase, and four lifts serve the kitchen and the restaurant, two of which are fitted with hotplates for keeping food warm. With the exception of the trades lifts in the flats and the service lifts in the kitchen, all the passenger and goods lifts are provided with variable-voltage speed control on the Ward-Leonard system, and patent inductor self-levelling apparatus.

Fig. 10.—Lighting Arrangements in Soda Fountain.

A separate motor-generator set is used for each lift. The motors driving the motor-generator sets are arranged for 400 volts, 3-phase, 50 cycles, and run at 1,450 r.p.m. By varying the field current of each generator, the voltage applied to the terminals of the corresponding hoisting motor can be varied up to a maximum of 230, so as to give the requisite speed variation. The five long-travel passenger lifts in the stores are operated by the latest gearless machines, which enable the lifts to run at speeds up to 450 ft. per min., with rapid and uniform acceleration and deceleration, and with complete absence of vibration. The 25-h.p., d.c. hoisting motors for these lifts are directly coupled to the hoisting drum without any intermediate gearing. The maximum speed of these motors is 64 r.p.m. Owing to the low speed, this special type of motor is completely noiseless in operation. The loading of each passenger lift is 2,500 lb. The remaining ten lifts in the store, as well as the staff lift and the flats passenger lifts, are operated by 25/30-h.p. d.c. hoisting motors, running at 750 r.p.m., directly coupled to low-ratio worm gears to give lift speeds of 200/300 ft. per minute, depending on the travel. These are attendant operated by car-switch control, and are provided with 4-piece, 2-way sliding doors at each landing.

The positions of the driving machines, controllers and motor-generator sets have been arranged to suit the lay-out of the building. In some cases the machines are arranged in a motor house on the roof, while in other cases the motor room is situated in the basement. In all cases the lay-out of the lift machinery has been so arranged that each part is readily accessible by the maintenance engineer, and all possible precautions have been taken to prevent the noise of the lift machinery penetrating to other parts of the building.

The electrical distribution arrangements present many interesting features. The supply is brought by duplicate cables from the l.p. side of the transformer in the h.p. room, 6,000/400 V, 3-phase, to eight links mounted on the wall of the switchboard room. From these links the supply is taken through meters to the main stores lighting oil switch and stores power oil switch. From the supply side of the meters a connection is taken for the flats lighting supply, and through a meter to the flats power panels. The supply to the flats for lighting and heating is metered in each individual flat. The main switchboard is arranged so that all connections at the back of the board are brought down to a series of links, so as to permit any cable to be disconnected easily and rapidly.

The main distribution from the switchboard is carried out with p.i., l.c., and double-wire armoured cables varying in size up to 0.3 sq. in., 4-core, with segmented conductors.

For the stores lighting, sub-main switch and fuse-boards are placed in the basement at each of the six staircases. Each is fed by means of one or more 4-core cables. From these sub-main boards single-phase supplies are taken up the rises to final distribution boards, which vary in size up to sixty 15-A ways. A special radial-type ammeter switch enables readings to be taken with one ammeter for checking the loads of the various departments.

For the supply of the pilot lights required by the L.C.C., a small transformer connected to another supply company's mains feeds the pilot-lighting distribution board of the standard china-unit ironclad type.

A number of automatic intercommunication desk telephones figure in the equipment of many of the chief administrative offices of the stores. In the flats internal telephones are used to establish communication between the hall porter's lodge and any flat, while a similar system is installed connecting with the tradesmen's entrance. In the flats are also installed bakelite bells, indicators, &c., for the usual domestic offices.

Fig. 11.—Quick-luncheon Buffet; Demi-coupe Brackets.

Provision for the lighting of the flats above the stores is so arranged that the supply is carried from the main switchboard to four 500-A main triple-pole switches, with links, situated two in each of the east and west blocks. A somewhat novel constructional feature concerning these was adopted owing to the limitations of

space, the switches being mounted in "Sindanyo" cases because of this method taking less room than metal cases. Cables are run from these to sub-distribution boards in each flat, enabling the tenants to arrange for metering according to requirements.

There is one other system of lighting that escapes the attention of many, and that is the store's control system of coloured-light signalling, whereby executive and staff members are always in the closest touch, no matter in which section of the store one or the other may happen to be. Little coloured disks beneath the clocks in the various departments speak a wondrous language. The signalling system is controlled by master switches in the central telephone operating room, and anyone can be called by the closing of certain switches which, in turn, produce various coloured-lighting combinations. The General Electric Co., Ltd., supplied the major portion of the various lighting fittings, lamps, and electrical equipment to which reference has been made in these notes, and Messrs. Higgins & Griffiths were the contractors for the whole of the electrical installation. Tribute should be paid to the masterly conception of Messrs. Josephs, the architects who were responsible for the magnificent scheme of general and local illumination. The floodlighting of the colonnade was carried out by the Franco-British Electrical Co., Ltd., in conjunction with Edison Swan Electric Co., Ltd.

Fig. 12.—Cornice Lighting in Restaurant.

Fig. 13.—"Striplite" Illuminated Window in Restaurant.

Drilling Operations.

A Method of Preventing Broken Drill Tangs.

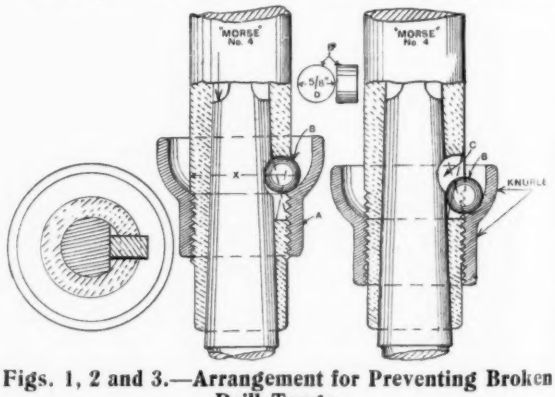
By J. T. TOWLSON.

THERE is no doubt that the provision of the taper and the tang for the twist drill is wise. That this method of preventing the turning (or twisting) of drills in their sockets has been well thought out is evident from the yeoman service it has, generally, given. Yet, drills, with their tangs wrenched off, are quite a common sight in machine-shops. The reasons for this are given below.

In the first place, no drill was ever known to have its tang wrenched off during a drilling operation at such time as the full value of the taper tightness, conjointly with the value of the tang, was secured. Only when the drill has been permitted to fall away from such taper tightness, and when the whole of the drilling stress has, consequently, come on the tang, has it (the tang) been wrenched off. This may happen when the drill does not seat as it should in its socket, and when, for example, the radius at the base of the tang finds a slight, yet effective, obstruction in the socket. That is *one* cause of broken tangs. Another cause is that, when drilling (especially with drills of comparatively large diameter), through a cored, or a previously drilled hole, the force tending to pull the drill from the socket is greater at times than that which would otherwise be effective towards keeping the drill up to its "taper-tightness" and tang. In order to meet these conditions, the writer has devised, and utilised, a way to prevent the "broken-tang" trouble; the means is effective not only for the purpose referred to, but also for holding the drill when the tang has been previously broken off.

Figs. 1, 2 and 3 show a No. 4 Morse socket with a suitable drill in position, and well up to its seat in the socket.

Fig. 1 shows the drill just "bumped up" tightly, in the way known to drillers. A collar A is provided,



Figs. 1, 2 and 3.—Arrangement for Preventing Broken Drill Tangs.

which, when screwed up by hand, guides the hard steel disk B into the space C by way of a suitable slot cut through the socket. The steel disk is shown in the secure and free positions in figs. 2 and 3.

The space C is just "ground" across the drill, and there is no groove in the drill to mill out, and the standard socket can well be used.

It will be seen quite clearly that to release the drill it is only necessary to unscrew the collar A quickly, when the disk B will fall away quite clear of the drill (as shown in fig. 1); the drill may then be forced out with the wedge commonly provided.

Electricity for the Home.

Progress Made in Domestic Electrification by Two Small Country-town Undertakings.

SO far in this section we have dealt chiefly with supply undertakings in some of the larger cities and towns in this country, or, at any rate, undertakings serving more or less densely populated areas. We propose on this occasion, however, to deal with two small country-town undertakings, Ashford, Kent, and Bury St. Edmunds, and in the light of the comments in our leading columns this week we suggest that the following notes will prove interesting and useful.

Ashford's Progress.

The kWh sold per head of population at Ashford, about 150, after four years' working, compares satisfactorily with larger towns which have been running for a much longer period. When getting out the original scheme for the undertaking the engineer, Mr. H. Wilson, A.M.I.E.E., considered the question of showrooms, and decided that in the initial stages the concern would have to do without them. While this is not advocated as a general policy, it may be of interest to other small towns to note that a great deal can be done without a proper showroom. Access to the general office on one side and to the engineer's office on the other is from the 8 ft. 6 in. square room depicted in fig. 2. This has a water heater in one corner and a cooker against the far wall, in addition to various electric fires and small apparatus, together with appropriate literature. Any person calling at the office is shown into this small hall, and there is no doubt that a great deal of apparatus has been disposed of from it. The great advantage is, of course, that the display costs nothing to run, as the staff who would have to be there in any case for other purposes look after it.

N.B.—This Card must be accompanied by an Official Application Form.

In consideration of the Electricity Dept. wiring the premises known as

for .....Electric Lights, I hereby agree to pay at 10d. per unit for each unit used, in the winter quarters up to 27 units, and in the summer quarters up to 9 units. All in excess of this amount to be charged at 1½d. per unit. The wiring to remain the property of the Department until I have paid for ..... units at 10d., and then to become my property.

Signed by Tenant .....

Approved by Landlord .....

Please state Wiring Contractor.....

FOR OFFICE USE ONLY.	Approved :—	
Site as Issued	Issue Slip	Service No.
Date Connected	Official Order	O.K.

Remarks :— A SMALL EXTRA PERCENTAGE WILL BE CHARGED OUTSIDE THE ASHFORD URBAN DISTRICT.

Fig. 1.—Simple Assisted Wiring Application Form.

Under Ashford's ordinary tariff for domestic premises a certain number of kWh, depending on the wattage installed for lighting purposes, is charged at 8d. per kWh, followed by an equal number of kWh at 1½d., and all in excess of this are charged at 1d. per kWh. In any case the customer only pays for the kWh actually used. When a customer's bill under this tariff begins to approach the amount which he would be asked to guarantee under the "all electric" rate, this is pointed out to him, and he usually changes over, when he obtains the guaranteed amount for any purpose at 0.9d. per kWh, and any in excess of this amount at 0.5d. per kWh. The guaranteed amount varies from £12 per annum upwards, according to the size and locality of the premises. There is quite a number of working-class families using lighting, cooking, and water heating, and buying the whole of their electricity for all purposes at an all-in figure of about 0.75d. per kWh. There is also a special tariff of 0.75d. per kWh for water heating, in which case the customer agrees to have his supply cut off between dusk and midnight; this is done by means of a relay operated from the street-lighting circuit, for which the customer is charged no rental. The undertaking has been criticised for the high price of 8d. per kWh that is charged for the initial consumption under the ordinary domestic tariff, but its experience suggests that customers would rather pay a high price for energy that is actually consumed than a rental charge which is applicable whether current is consumed or not.

In the four years during which the concern has been running the undertaking has held three exhibitions in the town, and various small ones in the surrounding villages, in addition to featuring two "all-electric" houses for one month.

The whole of the staff is on the look out for new property, changes of tenants, &c., and all such cases are followed up with a letter, which is frequently successful. A list of possible customers not at present supplied is being prepared, and as soon as the present demand is caught up it is the intention to write to prospective users, and to follow up each letter with a visit by a representative.

Under an assisted-wiring scheme about 1,400 customers have been obtained out of a total of 3,000. The procedure is very simple; the customer has only a small card to fill in, fig. 1, and no guarantees to give. In addition to five lighting points, the undertaking wires one switch plug for each installation, so that the customer can try an electric iron, kettle, &c.

Any apparatus which will consume a considerable amount of current, and for which there is any large demand, is hired out: cooking stoves at from 2s. 6d. per quarter upwards; fires from 1s. 6d.; and water heaters from 2s. 6d. Any apparatus is allowed to go out on trial without obligation on the part of the customer to keep it. If the apparatus is satisfactory the consumer will want to keep it; if it is not it is considered foolish to insist on his keeping it for any given period. From a financial point of view the hiring of cookers is open to criticism, as it is not possible to get an economic rental for them. Cookers which cost from £12 to £13 are hired out at 6s. per quarter, and with the interest and repayment over a period of seven years at 17.1 per cent. a definite loss which is made on the hire has to come

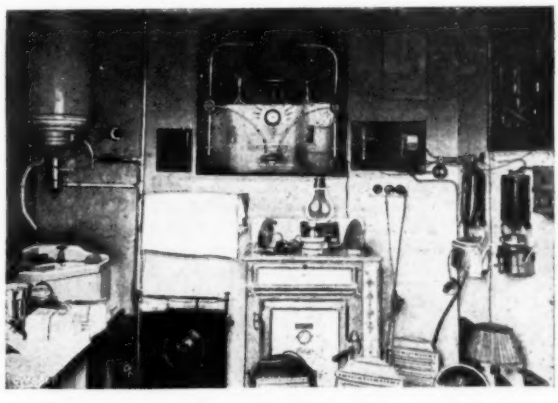


Fig. 2.—Entrance Hall at Ashford Offices.

out of the profit resulting from the energy sold. Where a customer uses 1,000 kWh per year on his cooker it is considered that the undertaking is in pocket on the total result.

The price of gas in the town is 5s. per 1,000 cu. ft., and the gas supply is controlled by a brother department of the U.D.C., with which a friendly rivalry exists.

There are at present about 400 cookers, 400 water heaters, and a great deal of small apparatus out on hire. Special attention is given to maintenance, as it is deemed that prompt and efficient service in this connection is particularly necessary in order to popularise domestic electricity supply.

It is the policy of the organisation to co-operate rather than compete with the electrical contractors. An electric development circle was started four years ago, and those concerned have met regularly once a month ever since to consider ways and means of furthering electricity supply. This arrangement has been very successful, and undoubtedly the contractors bring in a large amount of business through their efforts.

It is particularly interesting to note that with local generation in a district of about 50 square miles, with a population of approximately 30,000, it has been found possible to sell electricity at an average price for all purposes of 1.6d. per kWh, for an output of 150 kWh per head of population, and to make a small net profit on the first year's complete working. This has been accomplished with Diesel engines and underground mains, with assistance from the Unemployment Grants Committee. Almost anywhere in the Ashford area it is now possible for customers who wish to use lighting, cooking, and some water heating, or auxiliary heating, to buy the whole of their electricity at a cost not exceeding 1d. per kWh, which is, Mr. Wilson believes, the result which the Electricity Commissioners hope to attain in about 1940 by their centralisation scheme.

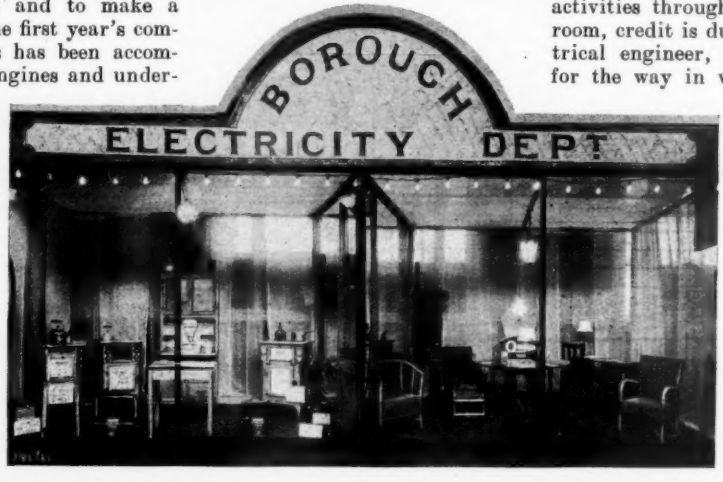


Fig. 3.—Electricity Display at Bury St. Edmunds Commerce Exhibition.

Development at Bury St. Edmunds.

The undertaking at Bury St. Edmunds serves an area of about 3,000 acres, with a population of approximately 17,000, 11 per cent. of which represents the number of consumers at present connected. The total output for the year ended March 31st, 1930, was 1,321,866 kWh, and the domestic output (excluding lighting) for the same period was 150,250 kWh. Prior to October, 1929, however, when the domestic supply campaign of the undertaking was first launched, the output was practically entirely non-domestic, excluding lighting. Since the domestic consumer has been catered for the growth of the load on the concern has been rapid, and the following connections are the results of the first year's domestic working: 105 cookers, 84 kettles, 74 flat irons, 67 fires, and 6 water heaters. These results represent a connected load of about 560 kW, or something like 80 per cent. of the total additional connected load (700 kW) during that period. The total connected load on the station is now round about 3,200 kW, approximately 18 per cent. of which represents domestic connections during the year ended October, 1930.

The tariffs governing domestic supply at Bury St. Edmunds are: flat rates, 5½d. per kWh for lighting and 2d. per kWh for other purposes; all-in rate, 15 per cent. of rateable value (minimum £2 10s. per annum) plus 1½d. per kWh consumed. All these tariffs are subjected to ½d. discount per kWh consumed for prompt payment, so that, in effect, there is in vogue a two-part tariff of 15 per cent. rateable value and 1d. per kWh consumed, an attractive proposition in a town the size of Bury St. Edmunds.

An assisted wiring scheme has been responsible for brisk business in connection with lighting and heating consumers, as also has a scheme for hiring out cookers, fires, &c., with regard to the domestic (non-lighting) load. Cookers may be hired at from 3s. 6d. per quarter, according to size, &c., fires from 2s. per quarter, and irons and kettles at 1s. per quarter. Most of the apparatus so far connected is hired out, although some has been purchased, either right out or by deferred payment. The hiring charges for cookers include free installation and full maintenance. The cost of the latter service has so far been practically nil.

Efficient service with satisfied consumers is the keynote of the department's business-getting methods, and a member of the staff is always available to attend to any defect connected with any apparatus hired out, and also to render any other desirable service. Every endeavour is made to induce consumers to hire "De Luxe" model cookers, as this is considered to be to the mutual advantage of consumer and supplier.

While the department is greatly handicapped in its activities through not having a showroom, credit is due to the borough electrical engineer, Mr. A. E. Knights, for the way in which, as far as possible, the difficulty has been overcome. Cookers and a restricted selection of fires are on show at the works, so that the undertaking and consumers are not denied entirely the advantages of display.

In the short time during which the domestic load has been pushed the undertaking has held two exhibitions in the Town Hall, one as recently as October 27th to 31st last. A stand was also taken by the department at the local Chamber of Commerce Exhibition held in September last year at the Corn Exchange. These displays have been instrumental in arousing the interest of consumers and prospective consumers regarding the domestic uses of electricity, and they have been attended with very great success. Fig. 3 depicts the excellent display by the Corporation Electricity Department at the Chamber of Commerce Exhibition referred to above.

In furtherance of the organisation's publicity work, non-consumers are circularised periodically, by districts, the propaganda material stressing the advantages of an electrical installation and giving particulars of the assisted wiring schemes. The contractors are notified of this work and asked to co operate by canvassing. The literature is sent out with the quarterly accounts. A very good feeling exists between the contractors and the department as a result of close co-operation. All wiring, with the exception of that for the Council houses, is carried out by the contractors, including cooking and assisted-wiring installations.

Every endeavour is made to interest local architects and builders in the advantages of amply catering for electrical requirements. This has resulted in practically every new building in the undertaking's area being wired for lighting, and in many cases for heating and cooking. All new premises built under the Corporation's housing schemes are wired for lighting.

The gas supply in the town is at 11d. per therm.

Copper, Lead, and Rubber Prices.

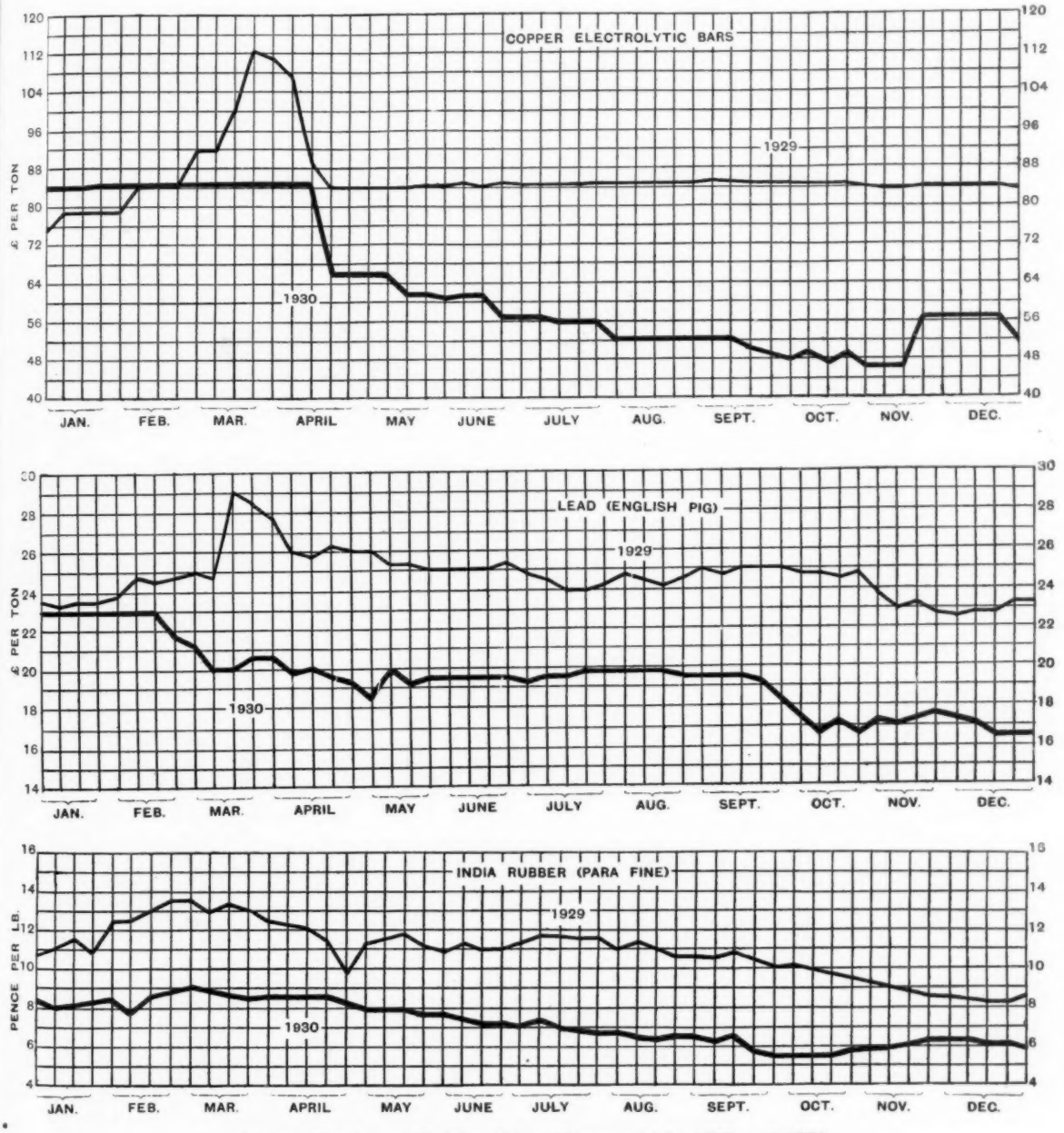
Movements During the Past Two Years Compared.

THE prices of the three leading raw materials used in the electrical industry were consistently lower during 1930 than in 1929, as will be seen from our customary curves below.

In the case of copper, this difference of price levels was most marked. Owing to the action of the leading producers, the price had remained steady for about a year, but in April last there was a sudden break which brought it down by £18 per ton in a week. Thereafter there was a continued decline until November, when a rally set in.

The lead price followed a downward course, which was continuous and gradual, with the exception of rather rapid falls in February and March and again in September and October. During the closing weeks of 1930 the price was fairly stable around £17 a ton, which was about £6 lower than the 1929 close.

After a slight recovery to 9d. a lb. early in the year, the price of india-rubber (Para fine) fell gradually to the lowest level ever recorded, in October. There was later some reaction, and during December the tendency was a slightly rising one with the produce at about 6d. a lb. It is interesting to recall, once more, that in 1910 the price of rubber was over 10s. a lb.



Copper, Lead, and Rubber Price Movements in 1929 and 1930.

At the end of 1913 the prices of the three commodities were:—Electrolytic copper bars, £67 per ton; English pig lead, £18 10s. per ton; and india-rubber, Para fine, 3s. 1d. per lb.

Fixing Selling Prices.

A survey of the economic laws affecting prices, with an explanation of a proper determination of selling prices.

By A. W. WILLSMORE, F.R.Econ.S.

THE average business man has the idea that selling prices are governed by cost of production. He is accustomed to think of a selling price as representing cost plus overhead charges plus a certain fixed margin of profit. In actual fact, however, this view is unsound. True, a manufacturer expects to obtain a certain margin over his cost of production, and he produces his goods with that object in view. The price he actually gets for them, however, is determined entirely by the market conditions and the balance between supply and demand. If the general condition of the market is such that the demand for the particular goods exceeds the supply, he can, and probably will, get more than cost plus standard profit. On the other hand, if the market is overstocked, he will probably have to content himself with less. He may hold his price at the preconceived figure in spite of these market conditions, but if he does so, his volume of business will suffer accordingly. It is surprising how many concerns ignore this simple economic fact in pricing their goods. Many a sales manager fixes a selling price for a particular article on the basis of commercial cost, plus, say, 25 per cent. profit, and in spite of any changes in market conditions, holds his price at that level until he is forced to reduce the figure because of the steady decline in business. In other words, he attempts to defy the economic law of supply and demand and holds out against it as long as he can.

Apart from this question of adjusting prices to market conditions, there is the problem of whether or not to give the consumer the advantage of reduced costs arising from improvements in manufacturing methods or resulting from the adoption of mass production. One might expect that the manufacturer who fixes his prices arbitrarily on the basis of cost plus profit would automatically pass on to his customer the benefits of reduced costs. In actual fact, however, this type of manufacturer usually endeavours to keep his prices at the previous level in spite of the economies. The enlightened manufacturer appreciates that this policy is bad business. Mr. Henry Ford, for instance, works on the basis that the right sales price is always the lowest price at which the article can be produced, and he contends that the manufacturer's duty, both to himself and to the public, is constantly to lower prices. There can be few who would contend that in Mr. Ford's case this policy has not proved successful, and, in fact, many other manufacturers have proved that in the long run this is the best policy to pursue. But although we admit that as a general rule the manufacturer should pass on reductions in cost in the form of reduced selling prices, we do not thus obtain a price-fixing procedure. For although he must constantly aim at lower prices, the manufacturer cannot fix his prices on cost of production without considering market conditions. The reason for this is that cost of production is not so stable an item as would appear at first glance. Unit cost of production depends entirely on the output of the factory. The cost of unit production is lower when a factory is running at full load than when it is only running at, say, 50 per cent. capacity. This fact arises from the existence of overhead charges.

Primary and Supplementary Costs.

The total cost of production is made up of prime costs and supplementary costs. The former are charges which vary directly as the output, such as wages, raw materials, fuel, lighting and power. These costs are represented directly in the commodity produced, and every increase in the quantity of output generally involves a corresponding increase in total prime costs. On the other hand, supplementary costs represent establishment charges incurred in connection with fixed capital, which do not vary appreciably with changes in output. The rent of the factory, management salaries, depreciation and similar charges, generally speaking, continue to be incurred whether the factory is working or not, and appreciably the same total amount must be charged to production whether the factory is slack or busy.

Let us assume, for example, that with a normal manufacturing load representing, say, 80 per cent. activity, the prime cost of factory output is £800,000, and that indirect supplementary costs amount to £100,000, representing a loading of 12½ per cent. If business is good and orders are received in sufficient volume to keep the factory working to full capacity, the prime cost of the output might increase to £1,000,000, while supplementary costs remained unchanged at £100,000 or 10 per cent. loading. If, on the other hand, very little work was available and the factory was operating at 50 per cent. load, the prime cost of output would be, say, £500,000, with supplementary costs only slightly lower than £100,000, or 20 per cent. loading. In other words, when business is good and orders are coming in at such a rate that the plant is already working to full capacity, the manufacturer would, by reducing prices, be encouraging still more business, while, on the other hand, when the factory is slack and orders are difficult to get, he would be charging higher prices for his goods and thus limiting his chances of obtaining a fair share of the reduced volume of business.

The " Price-Volume " System.

If, then the manufacturer is unwise to base his prices on cost of production, by what method is he to determine them? Several firms have found the answer to this problem by making what is known as a " price-volume " study for each product, and this practice can be recommended as a practical and reasonable solution to the question. The " price-volume " study is made annually, and its preparation is usually tied up with the company's budget system to ensure that proper attention is paid to the manufacturing and financial situation. The foundation of this " price-volume " study is the fact that price and demand have a direct relationship. An increase in price will usually result in a decrease in demand. Conversely, a decrease in price will bring about an increase in demand. The exact amount of change brought about will depend on the nature of the article. As a general rule, demand for the necessaries of life is inelastic, and price changes have only a small effect on demand, while demand for luxuries is elastic and price changes have a considerable effect on demand. For instance, a reduction of 50 per cent. in the price of bread would not lead to a very heavy increase in the amount consumed, but a 50 per cent. decrease in the price of, say, vacuum sweepers would give a considerable impetus to demand.

The object of the " price-volume " study is to attempt to forecast the elasticity of demand for each of the

main products of the company so as to determine the optimum price to adopt. The foundation of the study is an estimate of the sales that may be anticipated at various prices, bearing in mind competitors' prices. The volume of sales at each price is then converted to figures of value, and against these figures are set the costs of producing that volume of sales. In this way the company is able to fix the optimum price for each product at a figure to yield the largest net income. It may be that one article is sold considerably below cost, while another is sold at a rather high profit, but overall the combination of prices is such that the maximum net income is received.

Monopoly and Competition.

In certain cases it may be found that the optimum price indicated by the "price-volume" study is very high compared with cost, and it would seem that the rule of low prices established above is contradicted by such a study. Such a condition, however, arises out of exceptional circumstances, usually from the fact that the company has a monopoly of the supply of that article. The management should seriously consider its position on such items. While the peculiar circumstances remain in force, prices can probably be kept at this high level. In the long run, however, the play of competition will convert these circumstances to normal, and, before deciding to keep the price at the high figure, the management should consider what explanation it is going to offer of the heavy reduction in prices which it will inevitably have to make when competition enters the field.

When the "price-volume" study system is put into practice it will perhaps not be found quite so simple as it appears to be at first sight. The results achieved, however, more than justify the time and trouble involved, and it is contended that this is the only logical and safe method to adopt in the determination of selling prices.

Irish Water Power.

The Irish Free State Electricity Supply Board claims to have solved the River Shannon hydro-electric power problem; some of its achievements to date.

By R. N. TWEEDY.

(*Continued from page* 13.)

It is as well to remark that one of the big differences—and there are many differences—between your grid scheme and ours is that the I.F.S. Electricity Supply Board generates, transmits, transforms, and distributes to the ultimate consumer the whole of the energy used in the Free State, except the relatively insignificant quantity which is generated and used by private individuals and by a few factories which still retain their own plant. Although the Act permits authorised undertakers to purchase in bulk and to distribute within their statutory areas, or to sell in bulk to the Board, yet the actual effect of the Act, combined with the determination of the Board that nobody shall beat it at its own game, has been to eliminate every authorised undertaker and to inhibit the creation of new ones. Certainly any person whose cherished dream was to become an authorised undertaker would seek its realisation in some other country than the Irish Free State after once perusing the 1927 Act.

Dr. T. A. McLaughlin, managing director, Electricity Supply Board, Irish Free State. Sir Archibald Page, chief engineer, Central Electricity Board, Great Britain.

The Two Chiefs at Ardnacrusha.

So there is no middleman to come between the Board and the consumer with sticky fingers and a parochial outlook, and the Board is forbidden to make a profit on sales. It must adjust prices so that by "the appointed day," still two or three years distant, it will do no more than cover all charges and provide reasonably for the usual things.

Everything, in this strange State, is being done for the benefit of the consumer, nothing for the relief of rates or the enrichment of shareholders, or even—if I construe the section rightly—the application of surplus revenue to capital expenditure, a pernicious habit, particularly of municipal financiers, which has been exceedingly detrimental to the rapid progress of electricity supply.

Until the appointed day the Board could profiteer at discretion. What it has done is to fix its rates of charging by areas upon lines which would meet with approval in the best circles in England; the kind of undertaking, I mean, which figures in the special sheets you published some little time back; the good boys, in fact, who get better by selling a kWh at a penny and under.

We are quite in the fashion with our two-part domestic tariff, consisting of a percentage of the rateable value plus a kWh charge ranging from three-farthings in Dublin to twopence in some of the remoter parts; and we follow what appears to be the best practice with our block system for industrial power; but it seems to me we are distinctly

ahead of Great Britain, and probably of the world, in getting an *unrestricted-hour halfpenny rate over the whole country* for water heating.

With that rather lengthy interlude, which may have its uses later on for the reader, I am taking you back immediately to Dr. T. A. McLaughlin's speech at the Dublin Rotary Club luncheon.

Electric light has penetrated to the humble cottages in our country villages.

Seventy-five per cent. of the public institutions throughout the area of supply have been connected: shop windows in the towns and villages vie with Grafton Street, Dublin, in brilliancy by night; and already close on 100 of these places have their streets lighted to a standard which is in general superior to that in many parts of the City of Dublin.

Travelling through the country after dark one is particularly struck by the metropolitan aspect of the country towns.

An idea of the progress made in domestic electrification can be gathered from the sales of appliances from the Board's showrooms in Dublin and the provinces. There is no record of additional sales made by contractors and others.

Up to date 5,000 fires, 4,000 irons, 1,200 kettles, 900 cookers, 800 boiling rings, and 450 vacuum cleaners have been sold by the Board, besides a large number of miscellaneous appliances.

Personally, I think the foregoing record is much more a sign of what is to come, than any very remarkable accomplishment for the period during which the Dublin showroom alone has been at work.

If I had been the Doctor I should have felt inclined to use the data the other way round with better effect: for although the sales are not yet surprisingly large, yet if the news from the generating station is as good as you are going to read in a minute, what in the name of Faraday are we to expect when the Sales Department really gets busy? I see, for instance, that in New Zealand no fewer than 5,500 cookers, mostly of over 5 kW rating, were installed during 1929, and nearly 8,000 water heaters. Already in 1928 there were 15,766 cookers and 21,513 water heaters; but, with all that, the degree of saturation was a good deal less than 10 per cent. of the consumers of electricity generally.

What Dr. McLaughlin would have been well justified in calling very remarkable is the fact that during the year 7,000 h.p. of new small power had been connected in the towns and villages. This is in addition to motors changed over from local stations, and only refers to small power. That, and the fact that over 30 creameries have been connected, certainly were not expected to happen at such an early stage in the history of the scheme.

Finally, and most sensationally—bearing in mind the experts' estimates and the other people's forebodings, or forecastings, or whatever you like to call the cataracts of cold water that were poured over the scheme while it was trying to get born—what has been the degree of attainment of the load upon which the economic foundation of the scheme has to be based?

Two or three years after the start there was to be a peak load of 48,000 kW and a generation of 153 million kWh in the year.

Within fourteen months of the start the peak load has reached 46,800 kW, and very soon it is bound to reach the 48,000 mark.

As to the kWh, Dr. McLaughlin says it is perfectly safe to assert that the present monthly rate of generated energy corresponds to at least 153 million kWh in one year. Coupled with that he assures us that the selling price of energy is high enough, so that he looks forward with confidence to the financial result of the first complete year of trading. Until about a month ago nothing like complete trading conditions had begun, so that the first official financial year of real importance to the observer will be that ending on March 31st, 1932. Long before that we shall know definitely what to expect, and I have little doubt that even now the scheme is paying its way without recourse to the expedient of capitalising the interest on the capital, permitted under the Act until the "appointed day."

In view of certain articles and letters which have appeared in the technical Press, even recently, containing references to the capital cost of the Shannon scheme, I really must try to give you the facts as they are; not as they would be if somebody had to prove a case either for or against the Shannon scheme or a scheme in some other country.

The Shannon Electricity Act, 1925, authorising construction, provided that the total amount of advances made by the State should not exceed £5,210,000.

At any time during construction there was an abundance of sore-heads and Jeremiahs who alleged that the Minister would have to go to the Dail for enormous extra sums before energy could be delivered from the Shannon, and these birds of ill-omen were on tip-toe with a kind of ghoulish expectation when they heard in 1929 that the Minister was going to introduce an Amending Act.

Undoubtedly the sum of £625,000 for which Mr. McGilligan asked cannot be regarded as a small thing in a country of fewer than three million people, but it appeared that no more than £250,000 was due to increased costs of the scheme upon which the experts reported. As I understand nothing was put down for contingencies that must be as close an agreement between contract price and final settlement as anyone with experience in such matters could expect. On the other hand, all but £132,000 of the £625,000 was chargeable properly to the capital cost of the initial development. That item of £132,000 was incurred on navigation improvements instead of the estimated cost of £74,000. Another £20,000 spent on navigation improvements had been charged already against the power development.

£100,000 was for additional work recommended by the experts just too late for inclusion in the 1925 Act.

£150,000 was for administration expenses, which, by some oversight, were totally excluded from the original estimates

£53,000 was put in, rather belatedly, for "contingencies."

£100,000, representing the capitalised value of pole sites, is an item which is arguably not a constructional cost, being in the nature of annual wayleave rentals commuted by lump-sum payments; a most satisfactory arrangement, as it turns out, for the State.

Whatever the causes, the total cost of the initial development rose from £5,210,000 to £5,835,000, something near 12 per cent., and certainly nothing for which the Minister needed to apologise or of which the experts and the Government engineers needed to be ashamed.

In round figures the ascertained cost of the partial development, containing generating plant rated normally at 90,000 h.p., may be taken as £5,600,000.

Each of the three generators is rated at 30,000 kVA with $\cos \phi = 0.7$.

Roughly speaking, the cost without any transmission or transformers was about 3½ million pounds, leaving about 2 millions for everything outside the waterworks and the power station with plant.

All-in, the capital cost per horse-power, including interest on capital during construction, was £62. On the basis of 63,000 kW installed the capital cost was £93 per kW. Quite a large portion of the partial development costs must be spread over the further development in which the generating plant will be twice what it is now (126,000 kW instead of 63,000 kW installed). Probably eight million pounds is an ample estimate for the total cost of the further development, this having been estimated by the experts at £7,188,000.

These figures compare very favourably with the cost of low-head developments of the same order elsewhere, particularly in New Zealand.

As we are unaccustomed in these islands to think in terms of water-power development, we are apt not to evaluate correctly the figures relating to constructional cost, especially when an endeavour is made to compare

the kWh costs of hydro- and fuel-installations. Therefore, at the risk of being tedious, but with the intention of clearing once and for all the fog which seems to surround the Shannon figures, I propose to set out the items in the experts' estimate of the total costs of the partial and further developments. These are the figures upon which most commentators have worked, although the issue has been mixed further at times by others who have employed the figures which appeared in Siemens-Schuckert's detailed scheme and estimate upon which the experts reported, and which they modified in many instances.

TABLE I.

	Partial Development. £	Further Development. £	Total Cost. £
(*a*) *Power plant only.*			
Civil constructional works	2,538,000	1,130,000	3,668,000
Mechanical works ...	184,530	89,920	274,450
Electrical works	215,700	160,600	376,300
Purchase of land	35,000	15,000	50,000
	2,973,230	1,395,520	4,368,750
Interest during construction period and first year of operation—about 15% ...	446,770	208,480	655,250
Total investment in power plant only	3,420,000	1,604,000	5,024,000

Hence the capital cost, of the power plant only, per kW installed in the first stage was to be £3,420,000 ÷ 63,000 = £54, and in the further development £5,024,000 ÷ 126,000 = £40.

The stage called "further development" covers the complete mechanical and electrical equipment estimated to absorb the whole available water power of the Shannon scheme, but there is a third stage called the trial development in which the storage capacity of the head waters is proposed to be increased from 600 to 827 million cubic metres, which was estimated to entail an additional capital expenditure of £770,000. It is unnecessary for our present purpose to go beyond the second stage.

The production figure (at the power station) for the second stage, with 126,000 kW installed, equivalent to the production of 153 million kWh in the first stage, is 237 million kWh.

Both these production figures are *minima*, taking into account no ancillary development on other watersheds or the co-operation of the existing steam station in Dublin, which would enable use to be made of much of the flow over and above the continuous flow in a dry year.

The figures given so far have had nothing to do with the capital cost of transmission lines, and there would have been much less misunderstanding if commentators had left things at that. It is difficult enough to arrive at any useful comparison between capital costs of power development in different countries, but it is raising a difficulty to the power of an impossibility when transmissions are included in the comparisons. Nevertheless, as the figures have been quoted and misinterpreted so frequently, it is just as well to give them here.

TABLE II.

	Stage of development. Partial. £	Further. £	Total Cost. £
(*b*) 110-*kV network.*			
Transmission lines and transformer stations ...	373,835	59,065	432,900
For interest	56,165	8,935	65,100
(*c*) 38-kV network	969,080	245,200	1,053,800
For interest	144,920	14,280	158,200
(*d*) 10-kV network	213,000	182,000	395,000
For interest	32,000	27,000	59,000
Total investment ...	1,789,000	536,480	2,164,000

The experts estimated the load capacity of the 38-kV transmission network at about 25,000 kW, on the assumption that the load was distributed proportionally to the population of the medium and smaller towns; and they considered that load capacity would be sufficient for the first ten years. The judicious use of about 5,000 to 10,000 kVA of synchronous motors would raise the load capacity of the 38-kV network to 40,000 kW.

In the territories around the power station and the 110-kV transformer stations at Dublin, Cork, and Maryborough, large unforeseen loads could be connected without difficulty.

Since the I.F.S. Electricity Supply Board took over the system from the Government it appears that another 100 miles of 10-kV lines has been added to that network; but feeling, as I have felt all along, that the experts had taken an exceedingly safe position with regard to estimates of consumption, I should be very much surprised if the Board's chief difficulty were not keeping abreast of the demand for more and more copper, to say nothing of keeping ahead of it as, of course, it should do. Already in the more thickly populated areas there are to be heard complaints of serious pressure drop, and the designers of the suburban and rural distribution networks were not nearly optimistic enough when they sited the 10-kV transformer stations.

The effect of the additional capital cost on the cost of energy as estimated by the experts, 110,000,000 kWh sold, amounts to very little, as Table III shows:—

TABLE III.

Cost in pence per unit delivered at	Power House.	End of 110-kV System.	End of 38-kV System.	End of 10-kV System.
Original estimate	0.41	0.52	0.74	0.84
Now	0.46	0.59	0.81	0.90
Difference + ...	0.05	0.07	0.07	0.06

The effect of the additional capital which will have to be spent upon the distribution systems in the cities, towns, and villages, now that all estimates of consumption are being proved to be altogether too small, is likely to be more serious, but not a bit more serious than the result of exactly similar experiences in England, where the domestic demand, once given a chance, has grown so amazingly.

It is difficult to see why there should have been a moment's doubt in the mind of any intelligent person as to the demand on the national supply being at least 110,000,000 kWh by 1932, considering that the normal rate of increase observed in 1924 was bound to bring the demand in 1932 up to 98 million kWh, even if there were no Shannon development at all. As a matter of fact, the normal rate of increase was exceeded by 3 million kWh when 1929 came, and the Electricity Supply Board in that year informed the Minister that the estimate of consumption in 1932 had been fixed, on a conservative basis, at 144 million kWh, which would be beyond the capacity of the first-stage plant if the peak grew at the same rate.

How unreliable these estimates are, hence misleading to all concerned, can be gauged by two facts:—

(i) The pre-Shannon consumption per head of population was 18 kWh.

(ii) An analysis of the 1928 returns, totalling 67 million kWh, gave the following information as to use:—

Lighting took	17 millions
Heating and cooking took	4.75 ,,
Power took	39.50 ,, (including 19¾ millions for tramways)
Public lighting took ...	3.75 millions
Other purposes took ...	1.50 ,,

Now these two facts show clearly enough that Ireland has been absolutely starved electrically, and that the ratio existing between the consumption due to lighting and to heating and cooking is abnormal judged by modern standards. When lighting stands at 17 millions I should expect heating and cooking to be good for 17 × 6 = 102 millions at the least, and lighting in 1932 naturally is going to be very much more than in 1928.

Again, when the consumption per head was no more than 18 because there were no more than 36,000 consumers (say, 140,000 people out of about 3 millions) and only 13,000 or so of those consumers were in reach of a tariff which made anything but lighting possible, then one cannot be accused of wildly optimistic forecasting to raise the consumption per head in 1932 to Finland's figure ten years earlier.

(To be continued.)

[CORRECTION.—January 2nd issue, page 13, first column, seventh paragraph, for "Not less than 2,400,000 of the population have supplies of electricity" . . . . read "*have no*" . . . .]

Pulverising-machinery Protection.

A Descriptive Comparison of Various Types of Magnetic-pulley Separators.

By C. H. S. TUPHOLME.

WITH the extending use of pulverised fuel for firing boilers there has arisen the need for the proper protection of the delicate crushing machinery against the disastrous effects of stray iron entering the pulverisers. Such stray iron not only damages the crushing rolls, but there is also the danger of a spark being the cause of an explosion. Coal delivered to pulverised-fuel plant invariably contains a surprising amount of bolts, nuts, hammer heads, and other material which might easily wreck a pulverising mill. This foreign magnetic material can be entirely eliminated by means of a magnetic-pulley separator placed at some point ahead of the crusher in the conveyor system. When the material passes over the pulley containing the magnet, the tramp iron is attracted and held firmly against the belt with which it remains in contact until it leaves the magnetised zone, which is at some point beyond the under side of the magnetic pulley. The tramp iron drops from the belt after it leaves the pulley and is delivered to suitable boxes by means of a chute, the coal continuing on its course. The method of operation is evident from fig. 1. Material carried on a conveyor belt passes over the magnetic pulley which replaces the ordinary pulley at the discharge end of the conveyor system.

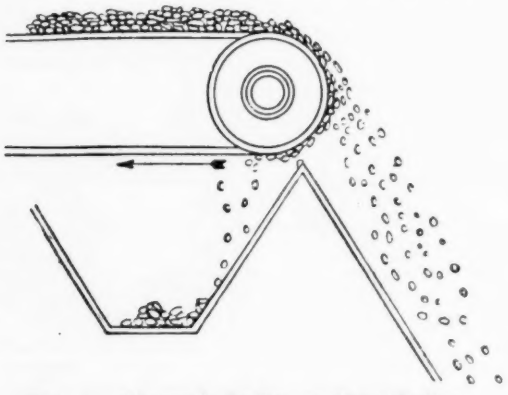


Fig. 1.—Magnetic Pulley as Head Pulley.

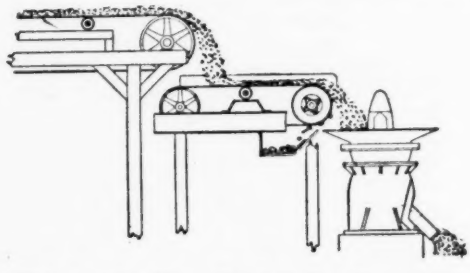


Fig. 3.—Auxiliary Head Pulley Separator.

There are three principles of application of a magnetic pulley. Fig. 1 shows the most common application, a magnetic pulley as a head pulley; the belt may be inclined, or horizontal as shown. Fig. 2 shows a magnetic pulley placed above the main conveyor belt, and this pulley then lifts the magnetic material upward. The third application, fig. 3, consists of a magnetic pulley used as a head pulley on an auxiliary complete pulley-type machine. The main conveyor belt may be narrow and heavily loaded, or it may travel at a very high speed; discharging the material from it on to a wider belt unit promotes a spreading out of the material, and a better separation is made.

The fig. 4 illustration is of a modern magnetic pulley made by Igranic Electric Co., Ltd., for a pulverised-fuel installation. The pulley consists of a number of steel disks keyed to a shaft, an electromagnetic winding being placed between alternate disks. The magnetising coils are wound on steel bobbins, which are dowelled to the disks to prevent shifting. The coils are all connected in series, and the terminal wires are brought through a hole in the centre of the shaft to a pair of collector rings fixed far enough beyond the edge of the pulley to permit the insertion of a bearing between the collector rings and the pulleys. The coils are impregnated with a moisture-repelling and insulating compound by the vacuum process, and the space surrounding them is filled with the same compound poured in the molten state during assembly. This insures perfect protection from moisture and, since the compound is a better heat conductor than dead air, cooler operation of the pulley is secured. A tubular brass spacer, which also performs the function of a coil shield, is placed between adjoining disks, and after assembly the pulley is turned and crowned.

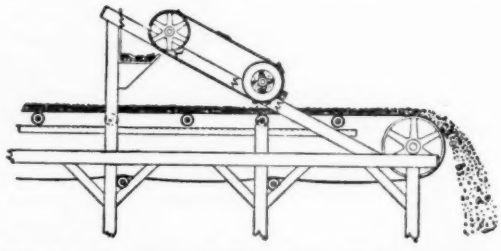


Fig. 2.—Separator Pulley above Main Conveyor.

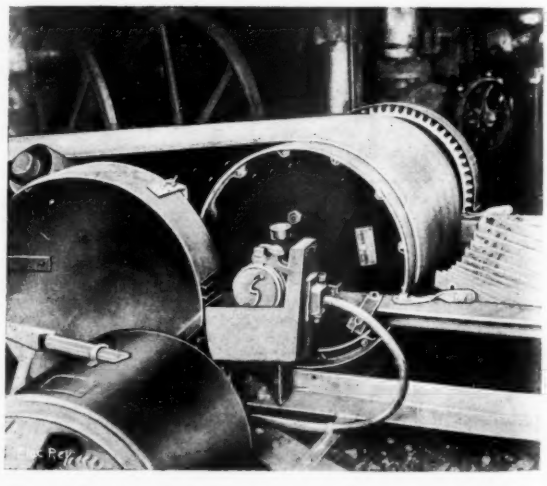


Fig. 4.—A Modern Magnetic Pulley in Service.

Large-diameter pulleys will in every case give better

results that those of small diameter from the standpoint of magnetic separation, and they will also reduce wear and tear of belt. With the same intensity of magnetisation the separation accomplished by a large pulley will be more perfect than that by a small one. The pulley diameter must be large enough to give the required traction and to suit the thickness of the belt. Good practice allows 3 in. diameter per ply; as for example, 18 in. diameter for a 6-ply belt. Small diameter pulleys, however, are much lower in first cost, and, where a short belt is installed, their use is permissible. Where conveyor flights are long, and especially where the magnetic pulley is a driving pulley for the conveying belt system, it is frequently economical to use a large diameter narrow-face pulley, because of the saving effected in the cost of a narrow belt. Standard pulleys are made in diameters from 12 in. to 30 in., and over in special cases.

In the case of one large power station the equipment for pulverising and drying fuel is contained in a separate building which is placed near one end of the boiler house, and the coal is dumped from the cars directly into a concrete track hopper adjoining this building. The plant is designed to handle either mine run or slack coal, and immediately below the track hopper is placed a set of rolls which reduce lumps up to 12 in. by 18 in. to 5 in. cubes or less in one operation. As the coal passes through this crusher it drops on to a belt conveyor, which discharges directly into a set of corrugated rolls. The upper end of the belt conveyor passes over a 24 in. by 22 in. magnetic separator pulley. This crusher reduces the coal so that it will pass through a ¾-in. mesh, or less, and delivers it into a dust-tight elevator, from which it is distributed into a storage bin over the coal dryer.

A separator pulley can often be used to replace the existing head sheave where a belt conveyor is being used, and in such instances it may be imperative to maintain the dimensions of the replaced pulley. Since a small diameter pulley is unsuitable for driving long or steep conveyor flights, it will sometimes be cheaper to install a separator pulley unit, say about 3 ft. long, on to which the main conveyor discharges. The magnetic separator pulley can then be used on the discharge end of this unit. A similar arrangement can also be used where the material to be separated is being discharged from a chute.

When dealing with lump coal, a magnetic pulley of 12-in. diameter will deal with from 10 cwt. to 30 cwt. in an hour; a 15-in. pulley with from 15 cwt. to 3 tons per hour; a 24-in. pulley with from 2 tons to 5 tons per hour; and a 30-in. pulley with from 2½ tons to 6½ tons per hour. These capacities are, of course, approximate, and they depend largely on the conditions of service.

Gas and Oil Engines.

Modern practice and development in connection with high-power plant for electricity generation.

By M. GERCKE, Chief Engineer, M.A.N. Co.

(Summary of a paper read before the INSTITUTE OF FUEL.)*

AT the outset the author refers to the progress made by high-powered installations in the generating stations of public electricity supply authorities, and analyses the advantages and disadvantages of the usual method, recommending that consideration should be given to the question that it is not always advisable to rely entirely upon large stations for every emergency. In this connection he suggests that peak loads and emergency loads should be carried by high-powered internal-combustion engines, gas or Diesel, because this type of plant offers many advantages from the technical and economic point of view. Further, it is pointed out that internal-combustion engines, particularly gas engines, occupy a traditional place in the iron, steel, and chemical industries of this country, as well as of Germany, France, Belgium, Luxemburg, and Russia, for the production of electricity, and the operation of gas, air, ammonia, &c., compressors.

Only stationary engines actually supplying practical service are dealt with in the paper, and no reference is made to experimental installations or theoretical suggestions. Technical features of high-powered gas engines are discussed at length, and examples of modern large-size gas-engine installations are described. Records of operation of gas-engine installations, test results, and comparisons of performance of gas engines and steam turbo-generators in metallurgical works, and gas-fired boilers are given at length, together with a comparison of operating and capital costs. The author predicts that the tendency of the future will very likely favour the use of:—

(1) steam-turbine installations, and gas-fired boilers for colliery and blast-furnace works, with attached steel works, rolling mills, &c., especially in works not having large home consumptions of power, and without an opportunity to sell power or gas;

(2) gas engines as generators for the base load, with waste-heat recuperation and steam-driven generators for the peak load, where the power supply is required for blast-furnace plant with attached steel works, rolling mills, and other steel-refining installations having a big power consumption;

(3) gas-driven blowing engines, or steam turbo-blowers, according to local considerations, for collieries, and iron and steel works;

(4) gas engines with waste-heat recuperators for driving high-pressure gas compressors for the chemical industry, long-distance gas distribution, and other purposes of a similar kind.

The tendencies of the latest developments of the M.A.N. Company in connection with high-powered Diesel engines are described, and the author discusses the suggestion of installing high-powered Diesel engines using coke-tar-oil fuel, and high-powered gas engines for stored blast furnace or coke-oven gas at convenient feeding points of the grid system, for producing a considerable percentage of the load, as far as possible, with quick starting internal-combustion engines, using super-stations only for the constant and fluctuating base loads.

The paper concludes with a lengthy comparison of figures and facts in connection with modern peak-load power installations in Germany, operating with oil, steam, and hydraulic installations.

As a rule, big peak loads only occur on some 180 to 200 week-days during the winter season; week-end days and holidays cause only limited peak-loads, and during the summer season peak loads are reduced to a minimum, excepting occasional cases of thunderstorms, fogs, rain, &c. Experience gathered, so far, has demonstrated that the peak-load installations are operated, as a rule, 500 to 800 hours per annum, and that the time factor of the maximum demand is 300 to 500 hours only per annum, *i.e.*, 2 to 2½ hours per peak-load day. The rest of the year the installations are idle. The Charlottenburg steam-storage plant may theoretically produce (Continental climate!) 180×73,000=13,140,000 kWh per annum, if the maximum storage capacity with full charge of the steam accumulators can be fully utilised for covering the peak load of the area of supply. This means that the theoretical time factor of the maximum demand is limited to 13,140,000/40,000 =329 hours per annum, based on the rated capacity of 40,000 kW, and to 13,140,000/50,000=262.8 hours, based on the temporary overload of 50,000 kW. The effective time factor of the maximum will be probably not more than 180×1=180 hours for 40,000 kW, and 180×45 minutes=135 hours per annum for 50,000 kW, because the storing capacity of the steam accumulators is exhausted after one hour approximately, if the engines are running with the rated full load of 40,000 kW, and after 45 minutes with the temporary overload capacity of 50,000 kW, respectively.

For comparison, the fact may be pointed out that the 10,500-kW peak-load Diesel engine of the Hamburg-Neuhof power house had an effective time factor of the maximum demand of 320 hours in the year of operation (1928), and of 416 hours in 1929. In the municipal power house of Bremen the corresponding time factors of the maximum demand of the 4,160-kW Diesel peak-load installation have been in the years 1926, 1927, 1928 and 1929, 554, 319, 581 and 242 hours per annum, respectively.

Diesel installations are superior to any other peak-load machinery and can easily, and without wasting fuel, follow the practical demand caused by the load conditions of the area of supply. On the other hand, the storage peak-load installations are handicapped more or less by the limited storing capacity of their steam or water tanks. If the power consumption for lighting continues to increase on a large scale, the consequences will be, not only higher peaks, but an increased time factor of the maximum demand of these peak loads as well. The running expenses per kWh of the peak load supplied to the consumer do not differ very essentially from each other, in spite of the diverging individual fuel and capital costs. This means that the production of peak-load electricity must not be considered from the traditional point of view: the reduction to the minimum of the cost of production per kWh, because this item is of minor importance in this particular case. The more essential remainder of the desiderata which must be fulfilled by efficient peak-load installations, include: unlimited production of power at any time; unlimited flexibility of operation; and unlimited installation in the centre of consumption at any suitable place in the area of electricity supply.

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* The meeting was held in London jointly with the Diesel Engine Users' Association, the Institution of Petroleum Technologists, and the Coke Oven Managers' Association.

Business and Industrial Notes.

The Week's Electrical Trade News from all Sources. Commercial and Industrial Developments, Business Changes, Market Prices for Materials, Trade Openings, New Publicity Literature, Liquidations, and Failures.

The "Electrical Review" Index.

The Index to Vol. CVII (for the half-year ended December 31st, 1930) is in course of preparation and will be published shortly. We shall be glad to receive the names and addresses of those who require it (free of charge), for binding purposes, or wish to retain it for reference. Application should be made as early as possible to the Publisher, 4, Ludgate Hill, E.C.4.

Central Electricity Board Contracts.

The Central Electricity Board announces that it has placed contracts with SIEMENS BROTHERS & Co., LTD., for primary transmission lines, and with the FULLER ELECTRICAL AND MANUFACTURING Co., LTD., for primary transformers, both in connection with the East England Electricity Scheme, 1930. The total value of the work is approximately £270,000.

The Buenos Aires Exhibition.

The December 20th issue of *British Industries*, the official organ of the F.B.I., takes the form of a special number devoted to the British Empire Trade Exhibition, Buenos Aires, intended for circulation in the Spanish-speaking countries of South America. For this reason it includes a number of articles in Spanish which explain what the Exhibition is and how British industrialists are able and willing to supply the needs of those countries. Among these articles we observe the following: "The Reason for British Supremacy in the Exportation of Electric Cables," by Mr. H. B. Atkinson; "The Universal Competitive Power of the British Electrical Industry," by Mr. V. Watlington; and "Electrical Equipment for South America," by an engineering correspondent.

Recent Contracts.

The WESTINGHOUSE BRAKE & SAXBY SIGNAL Co., LTD., was recently awarded the contract for the re-signalling work at Chesterton Junction by the London and North-Eastern Railway Co. This installation is for mechanical and electrical signalling with hand-generator operation of outlying points and signals. The material required will include a 50-lever mechanical interlocking frame with all the necessary mechanical connections for points and signals, signal arms, posts, &c.; also all track-circuit and allied apparatus. Three pairs of points and five signals are to be operated by the Westinghouse hand-generator system. The London and North-Eastern Railway has also awarded a contract to the Westinghouse Brake & Saxby Signal Co. for the re-signalling work at St. Ives. This installation is for mechanical and electrical signalling with low-voltage operation of outlying points and signals. The material required in the installation will include a 70-lever mechanical interlocking frame, with all mechanical connections, electrical and track-circuiting apparatus, as for Chesterton, except in the case of the two outlying points and four signals, which will be operated by the low-voltage system.

Messrs. WINGROVE & ROGERS, LTD., have sent us particulars of a number of recent orders for their trolley locomotives and trucks. A number of "B.E.V." locomotives are being used on the Southgate extension of the London Electric Railways by the contractors, Messrs. Charles Brand & Son. The same contractors are using two of the company's battery locomotives in connection with the Walham Green sewer contract. All the foregoing are fitted with batteries supplied by the New Distributors of Edison Storage Batteries, Ltd. The Erith Construction Co., Ltd., has ordered two two-ton elevating platform trucks, each with a spare Chloride battery.

STANDARD TELEPHONES AND CABLES, LTD., has received the order from the G.P.O. for the Bayswater automatic telephone exchange equipment, which will have an initial capacity of 4,600 lines and an ultimate capacity of 10,000 lines. This equipment, forming a new exchange in the London Telephone Area, will be situated in Moscow Road, W.2.

Unemployment.

An increase of 108,779 in the number of unemployed is recorded for the week ended December 22nd, the total at that date being 2,408,371, as compared with 2,299,592 at December 15th. No figures are available for the corresponding week of last year.

E.T.B.I. Competition Result.

Capt. J. T. Keeping, M.C., the secretary of the Electrical Trades Benevolent Institution, sends us the names of the prize-winners in the recent "House Competition" organised in aid of the funds. The area in which most tickets were sold was Lancashire and Westmorland, and the following were awarded the principal prizes:—1st, Mrs. M. Simmons, Ilford, "Electrolux" cleaning outfit; 2nd, Mr. C. W. Fraser, Lanarkshire, "Ensign" camera; 3rd, Miss M. Eastwood, Pinner, "Mullard" loud-speaker; 4th, Miss G. Wood, Pinner, "Godwinex" eliminator; 5th, Mrs. R. Jones, Harrow, "Goltone" radio components; and 6th, Mr. W. Carmichel, Islington, "Mullard" loud-speaker. A total of 71 prizes were allotted, and have been dispatched to the successful competitors.

Electrical Activity.

The B.E.A.M.A. Index of Activity, quoted by the *Board of Trade Journal*, was given as 93.6 for November (1924=100), as compared with 98.8 for October and 114.6 for November, 1929. The total amount of electricity generated by authorised undertakers in Great Britain was 1,035 million kWh, as compared with 963 millions in October and 1,005 millions in November, 1929.

Electricity Supply Wages.

The No. 5 (West Midlands) Area District Industrial Council for the Electricity Supply Industry announces the following reductions in wages on and after January 1st: Hourly wages by ½d. per hour; weekly wages for 48 hours by 2s. per week; weekly wages for 47 hours by 1s. 11½d. per week; youths and apprentices, 9d. per week reduction for boys, 16 and 17 years of age; 1s. 4d. for youths of 18 to 20.

Polish Foreign Electrical Trade.

According to the *Board of Trade Journal*, during October last imports into Poland of conductors, apparatus, and other electro-technical materials had a value of 5,942,000 zloty (£137,000), while exports of the same class were valued at 45,000 zl. (£1,000).

Further D.O.T. Commercial Guides.

The Department of Overseas Trade has sent us a copy of a booklet entitled "Hints for Commercial Visitors to Turkey" prepared by the Commercial Secretary to the British Embassy, Istanbul (Constantinople). This gives in brief form a good deal of information regarding routes to Turkey, the cost of living, climate, communications and many other matters. We have also received a similar guide dealing with Portuguese East Africa.

Trade with Brazil.

The Department of Overseas Trade announces that Mr. Stanley G. Irving, the Commercial Secretary to the British Embassy at Rio de Janeiro, is now in this country on an official visit. Mr. Irving will be available at the offices of the Department during the periods February 2nd-6th, and 23rd-27th to interview manufacturers and merchants interested in the export of British goods to Brazil. He will also visit a number of industrial centres in the provinces. Firms desiring interviews with Mr. Irving in London, or information regarding his arrangements to visit provincial centres, should apply to the Comptroller-General of the Department, 35, Old Queen Street, S.W.1, quoting reference 2111/1/30.

The Australian Duty on I.C. Engines.

The effect of the duty of 55 per cent. recently imposed on crude oil engines of between 90 and 1,000 h.p., and on gas engines of 90 to 200 h.p., which were previously duty free, is shown in the case of Toowoomba (Queensland) Power & Electric Light Co. The company has invited tenders for a crude oil engine of not less than 600 h.p. and the duty will increase the cost by at least £2,000. It is contended that an Australian engine cannot be produced at the same price as the imported engine.

Australian Duty again Postponed.

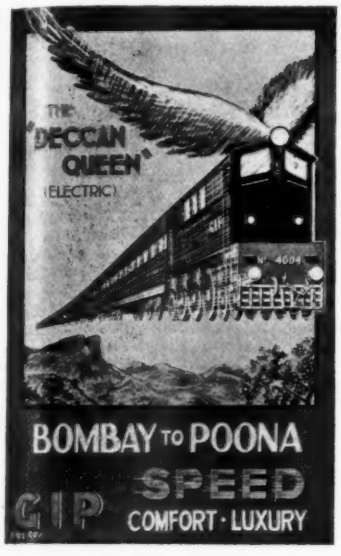
The coming into force of the duty on valves for wireless telegraphy and telephony upon importation into Australia has been further postponed until July 1st, 1931.

The New Chinese Customs Tariff.

Considerable differences in classification have been made in the new Customs Tariff published by the Chinese Government on December 31st, and operative from January 1st. The Department of Overseas Trade has sent us a memorandum summarising the alterations from which it is seen that the duties on electrical machinery, prime movers, boilers, &c., have been reduced to 7½ per cent. *ad valorem*.

A G.I.P. Poster.

We illustrate herewith a poster we have received from the METROPOLITAN-VICKERS ELECTRICAL CO., LTD., showing the "Deccan Queen" electric express, which is being run on the Great Indian Peninsula Railway between Bombay and Poona. The time taken by this train, with two intermediate stops, is 2 hours 53 minutes from Bombay to Poona, and 2 hours 57 minutes from Poona to Bombay, as compared with the old steam timing, with six intermediate stops, of four hours. The timing of the "Poona Mail," another electric train, is 3 hours 8 minutes from Bombay to Poona, and 3 hours 10 minutes from Poona to Bombay, with six stops intermediately. Actually, therefore, taking into consideration the stops at intermediate stations and the time of acceleration, the "Poona Mail" is a faster train than the "Deccan Queen." These two electric locomotives form part of an order placed with the Metropolitan-Vickers Electrical Co., Ltd., for 22 passenger locomotives each weighing 102 tons, together with freight locomotives for the same line.



A G.I.P. Poster.

Social Events.

SIMPLEX CONDUITS, LTD., recently held their annual Christmas party. After an excellent dinner, Mr. Randell, in proposing a vote of thanks to the directors and management, expressed appreciation of the sympathy and consideration always shown by them, and said that co-operation between management and staff meant a far greater efficiency. Mr. McLoughlin, managing director, suitably responded. Mr. A. J. Spiller, secretary, paid a warm tribute to the exertions of the Welfare Committee, whose hard work had made such a pleasant evening possible. The proceedings terminated with an enjoyable dance.

At the Norfolk Hotel, Hyde, on December 29th, the salesmen of the ebonite and mechanical departments of REDFERN'S RUBBER WORKS, LTD., were entertained to dinner by the directors during a conference held at the head office to consider the programme for 1931. In proposing the toast of the company, Mr. R. Barrington (London) said that it was a source of satisfaction to the salesmen to know that their company was alive and alert to the potentialities of the business, and he wished it continued success. Mr. J. Arthur Redfern, works managing director, in responding, assured them of their continued desire to work in the closest co-operation with the men on the road who were in touch with the tendencies of trade development.

The staff and employés of Messrs. PARTRIDGE, WILSON AND CO., Leicester, numbering over 60, were entertained to dinner in the Oriental Rooms, Leicester, on Christmas Eve, and after an excellent repast, suitable presentations were made to the host and hostess, Mr. and Mrs. H. G. Wilson. The sales manager, Mr. E. E. Wilson, in an informal speech, made an appeal for an even greater unity of effort in the coming year.

New Catalogues and Lists.

MUIRHEAD & CO., LTD., Elmers End, Beckenham, Kent.—A most comprehensive catalogue of recorders, direct writers, Wheatstone receivers, magnifiers, cable and landline relays, automatic transmitters, driving forks, phonic motors, testing apparatus, resistance boxes, artificial lines, condensers, inductance shunts, &c. The publication is profusely illustrated and is bound in a stiff cloth cover.

The ELECTRICAL EQUIPMENT & CARBON CO., LTD., 107-111, New Oxford Street, London, W.C.1.—Price lists K.P.5 and 6 relating, respectively, to cable terminals, sockets, binders, and clamps, and "Central" cone and "Concentric" terminals.

BAXTER & CAUNTER, LTD., 221, Tottenham Court Road, London, W.1.—January list of domestic electrical apparatus and accessories.

CROMPTON PARKINSON, LTD., Guiseley, Leeds.—A brochure suggesting a change-over to Parkinson motors with the standardisation of the national electricity supply system.

SIEMENS ELECTRIC LAMPS & SUPPLIES, LTD., 38-39, Upper Thames Street, London, E.C.4.—Catalogue No. 472 (superseding No. 199), dealing with Siemens enclosed lighting units.

L. G. HAWKINS & CO., LTD., 30-35, Drury Lane, Kingsway, London, W.C.2.—Particulars of a New Year's gift of twelve "Universal" electric irons. Also leaflets describing the "Directolite" store lighting fittings and the "Pye Twintriple" portable radio receivers.

SIMPLEX CONDUITS, LTD., Garrison Lane, Birmingham.—A leaflet detailing the merits of "Simplex" reflectors. Also a folder dealing with "Simplex" signs.

MARCONI'S WIRELESS TELEGRAPH CO., LTD., Marconi House, Strand, London, W.C.2.—Leaflet No. 1,124, giving particulars of the new Marconi 50-watt short-wave set, specially designed for installing in tanks and other armoured vehicles.

The MIDLAND DYNAMO CO., LTD., Belgrave Gate, Leicester.—An illustrated folder describing the improved "Quickway" coil-winding and forming machine.

Calendar-blotters for January have been received from the following:—MAVOR & COULSON, LTD., 47, Broad Street, Glasgow, S.E.; the JACKSON ELECTRIC STOVE CO., LTD., 143, Sloane Street, London, S.W.1; POPE'S ELECTRIC LAMP CO., LTD., 5, Arthur Street, New Oxford Street, London, W.C.2; the LANSTON MONOTYPE CORPORATION, LTD., Fetter Lane, London, E.C.4; and S. ROGERS & CO., LTD., 15, Fitzroy Street, Tottenham Court Road, London, W.1.

DELAKELLE, LTD., 30, Newgate Street, E.C.1.—Two illustrated pamphlets giving details of the company's electric cigarette lighter for cars and motor-cycles.

Trade Announcements.

With reference to a paragraph which appeared in our issue of December 12th (p. 1001), CEAG, LTD., Barnsley, Yorks., whose well-known lamp was mentioned, wishes us to make it clear that it is the only company which has the right to manufacture and sell "Ceag" lamps and accessories.

To cope with the expansion of business, the "TYPERLITE" COMPANY has taken further accommodation at 26, 27 and 30, Bush Lane, E.C.4. 30, Bush Lane, is to be used as a display room for "Typerlites" and 26 and 27 for a workshop and stores.

MARCO REFRIGERATORS (1929), LTD., has opened new showrooms at 223 and 225, Deansgate, Manchester.

For Sale.

The Controller of Supplies, H.M. Office of Works, has for sale in the Whitehall Area, electric fans and d.c. motors.
(See our advertisement pages to-day.)

New Companies Registered.

During 1930 we published in our "New Companies Registered" columns brief details of 415 new concerns, all of which were connected with the various branches of the electrical industry. In 1929 particulars of 404 companies were given.

A Christmas Showroom Display.

The accompanying illustration shows a corner of the showroom at 36, Park Place, Leeds, of the ELECTRICAL DISTRIBUTION OF YORKSHIRE, LTD., with an attractive display which was made at Christmas time. This display is still being maintained with the exception of the figure of Santa Claus, and has attracted considerable interest. The showroom is floodlighted in addition to the ordinary illumination and standard lamps.

The Yorkshire Company's Christmas Display.

Condenser Manufacture in Australia.

The Melbourne *Argus* reports that Mr. D. J. Doughton, managing director of the Australian Engineering Equipment Co., of Melbourne, has returned to Australia after having obtained a promise from the Telegraph Condenser Co., of London, that it will establish a factory in Australia to make condensers.

Contractors' Supplies for Greece.

A confidential report on the market for electrical contractors' supplies in Greece has been prepared by the Department of Overseas Trade from information furnished by the Commercial Secretary to the British Legation at Athens and issued to firms whose names are entered on its Special Register. United Kingdom firms desirous of receiving a copy of this report should communicate with the Department, 35, Old Queen Street, S.W.1, quoting reference number A.X. 10649.

Local Exhibition.

PETERSFIELD.—The first electrical exhibition held in Petersfield, organised by the Petersfield Electric Light & Power Co., Ltd., was held in the Drill Hall from December 10th to 20th. Mr. Seward, chairman of the Rural District Council, performed the opening ceremony and congratulated the company on the progress it had made. Mr. Houblon, a director of the company, announced that a reduced scale of charges would come into force in the New Year. The company adopted a wide advertising scheme before the opening of the Exhibition, which attracted a large number of visitors not only from Petersfield itself, but from surrounding districts. One of the features of this scheme was the flood-lighting of the old Parish Church and the William of Orange statue which occupies a

The Petersfield Electrical Exhibition.

prominent position in the centre of the Market Square. This was accomplished by means of three 1,000-watt projectors erected in suitable positions.

A comprehensive display of domestic appliances was exhibited by the following companies:—General Electric Co., Ltd.; H. W. Sullivan, Ltd.; Jackson Electric Stove Co., Ltd.; Edison Swan Electric Co., Ltd.; A. G. Suthers; Hoover, Ltd.; A. S. Sayer; W. Keast; Singer Sewing Machine Co., Ltd.; and D. E. Hobbs. A general view of the Exhibition appears in the accompanying illustration.

Bankruptcy Proceedings.

W. F. O. SEWELL, 24, James Street, Bradford, trading as "The Commercial Electrical Co.," electrical engineer.—A deficiency of £578 was disclosed in the statement of affairs produced by this debtor when he attended recently at the Official Receiver's Office, Bradford, for the first meeting of his creditors. The case, being a summary one, was left in the hands of the Official Receiver as trustee of the estate.

G. G. GRIEVE, electrical and mechanical engineer, 57, Diana Street, Cardiff.—Application for discharge to be heard at the Law Courts, Cathays Park, Cardiff, on February 3rd.

E. BALL, electrical contractor, Old Hall Street, Middleton.—Last day for receiving proofs for dividends January 17th. Trustee: J. D. Turner, Byrom Street, Manchester, Official Receiver.

Company Liquidations.

SOUTH STAFFORDSHIRE TRAMWAYS (LESSEE), CO., LTD.—Winding up voluntarily. Joint liquidators, Messrs. R. P. Beddow and T. H. Underhill, 88, Kingsway, W.C.2.

J. P. HALL & CO., LTD.—Winding up voluntarily. Liquidator, Sir Leonard J. Coates, 2, East Parade, Leeds. Sir Leonard informs us that he intends to keep the works in operation for a further period for the purpose of completing orders on hand.

READ RADIO, LTD.—A meeting of the company will be held on February 3rd at the offices of Messrs. Crane, Houghton and Crane, 30a and 31, St. Paul's Churchyard, E.C.4, to receive an account of the winding up of the company by the liquidator, Mr. A. Houghton.

Private Arrangements.

A. J. TARRANT, electrical engineer, William Street, Burton Latimer.—At a recent meeting of creditors held at Northampton, a statement of affairs was presented showing liabilities of £639 and net assets of £498, leaving a deficiency of £141. It was stated that owing to pressing creditors a deed of assignment had already been executed to Mr. H. C. Palmer, Kingham Chambers, Northampton. The debtor commenced trading in 1922, with little or no capital. After about two years he entered into partnership with another, the partner introducing £50. The partnership was dissolved in 1928 and since that date the debtor had traded alone. The drawings had been small. An offer was made of a composition of 10s. in the £, payable as to 3s. 4d. in cash, and the balance by two equal instalments at three and six months, the last to be guaranteed. During the discussion the opinion was expressed that the offer was not sufficient, and it was decided to confirm the deed of assignment already executed. A committee was appointed, and the trustee was authorised to sell the estate to the debtor or his nominee for such a sum and on such terms as the committee might approve. The principal creditors are:—

	£		£
Electrical Components, Ltd.	125	Premier Accumulator Co., Ltd.	112
Crompton Parkinson, Ltd.	76	A. J. Coleman	35

Winding-up Petition.

HAW & CO., LTD.—A petition for the winding up of this company has been presented to the High Court by Ernst Breitenborn, Leipzig, and will be heard in London on January 12th.

Calendars, Diaries, &c.

There is a quotation for every day in the 1931 calendar of Messrs. B. S. & W. WHITELEY, LTD., Pool-in-Wharfedale.

Two neat little note pads with imitation tortoiseshell covers have been sent us by the VARLEY MAGNET CO., Woolwich, S.E.18.

The 1931 diary of the ELECTRICAL POWER ENGINEERS' ASSOCIATION is a strongly-bound book of convenient size containing information regarding the Association, the National Joint Board and other matters, as well as squared paper and technical data.

From the ATELIERS DE CONSTRUCTIONS ELECTRIQUES DE CHARLEROI we have received a diary of pleasing appearance, with ample note space and particulars of the company's organisation.

The CONCORDIA ELECTRIC SAFETY LAMP CO., LTD., Cardiff, has issued a calendar bearing the portrait of "Ruth," a pretty blonde. The calendar of Messrs. HASLAM & STRETTON, LTD., Cardiff, is of a similar character.

The subject of this year's calendar of Messrs. FREDERICK HODGSON & CO., LTD., 24, Queen Victoria Street, E.C.4, is "The Clipper *Ariel* Racing the *Taeping*," by Charles Dixon, R.I.

A refill for the company's desk calendar has arrived from the SUN ELECTRICAL CO., LTD., 118-120, Charing Cross Road, W.C.2.

POPE'S ELECTRIC LAMP CO., LTD., 5, Arthur Street, W.1, has issued a wall calendar with large boldly-figured monthly sheets.

A picture of a pretty girl in a cut-out representing a radio valve again forms the calendar of the MULLARD WIRELESS SERVICE CO., LTD.

The DAVENPORT ENGINEERING CO., LTD., Bradford, retains the familiar cooling-tower design for its 1931 calendar which has a block of daily slips.

A wall calendar with monthly sheets has been sent us by Messrs. BROTHERTON & CO., LTD., Leeds.

"The Pixies' Carnival" is the title of a drawing in colour upon the 1931 calendar of MR. CECIL RIDLEY, Middlesbrough.

Messrs. CHARLES CLIFFORD & SON, LTD., Fazely Street Mills, Birmingham, have sent us a neat ash tray in "Seacliff" pewter alloy, which is used for many purposes.

A block of large daily slips on a simple card form the 1931 calendar of the EDISON SWAN ELECTRIC CO., LTD., Queen Victoria Street, E.C.4.

A brown-eyed beauty, *très décolleté*, graces the 1931 calendar of the METROPOLITAN-VICKERS ELECTRICAL CO., LTD., Trafford Park, Manchester.

Mr. GEO. BARNARD, 1, Nile Street, Birmingham, has sent us a refill for his calendar frame and a very neat pocket diary.

From BRITTAIN'S ELECTRIC MOTOR CO., Lewisham, S.E.13, we have received a business-like wall calendar with legibly-printed monthly sheets.

Book Notices.

"The Electrical Engineer's Year Book, 1931" (pp. 478 +diary). London: S. Davis & Co. (Aldwych), Ltd. Price 21s., post free. The 23rd edition of this publication covers all branches of the electrical industry and contains sections devoted to generation, selection and installation of cables, trade promotion, the application of electricity for lighting and power purposes, electric motor control, electric vehicles and trucks, installation of telephones and bells, and electric cooking, heating and cleaning. Official rules and regulations are given, together with a quantity of general information and a useful list of electricity supply authorities in the United Kingdom, giving supply voltages, charges, &c. A list of London streets in which electricity mains are laid is also included, as well as a list of the most important colonial and foreign electricity undertakings. The matter has all been carefully revised, but the general scheme is similar to that of previous editions.

"Electrical Equipment," by T. C. Lloyd. Pp. ix+287; figs. 185. London: Chapman & Hall, Ltd. Price 17s. 6d. net.

"*Transactions* of the Institution of Engineers, Australia," Vol. IX, 1928.—This volume is published in an abridged form

consequent upon the fire at the printer's premises in 1929, when large quantities of printed material, standing type, and process blocks were destroyed.

Miscellaneous Publications of the U.S.A. Bureau of Standards.—No. 115; annual report of the Director of the Bureau of Standards to the Secretary of Commerce for the fiscal year ended June 30th, 1930. Price, 10 cents.

The A.E.G. in Belgium.

It is stated that the Société Luxembourgeoise A.E.G. pour Entreprises Electriques, of Luxemburg, has decided to form a branch in Belgium under the title of the Société Luxembourgeoise A.E.G. pour Entreprises Electriques, Succursale Belge. The headquarters of the company will be situated in Brussels, while agencies will be established in Antwerp and Liège.

"Economy."

This was the title of an address which Sir Ernest J. P. Benn, Bt., C.B.E., was to deliver at yesterday's monthly luncheon of the British Engineers' Association.

Prices of Raw Materials.

The following prices are only general, and they may vary according to quantities and other circumstances:—

	CHEMICALS, &c.	Price Jan. 6th.	Fortnight's inc. or dec.
a	Acid, Oxalic ... ... per lb.	5½d.	...
a	Ammoniac, Sal ... ... per ton.	£60	...
a	Ammonia, Muriate (large crystal) ,,	£52	...
a	Bisulphide of Carbon ... ... ,,	...	...
a	Borax ... ... ,,	£17	...
a	Copper Sulphate ... ... ,,	£25 10s.	...
a	Potash, Chlorate ... ... per lb.	3d. to 4d.	...
a	,, Perchlorate ... ... ,,	5½d.	...
a	Shellac ... ... per cwt.	£13 10s.	...
a	Sulphur, Commercial ... ... ,,	£11	...
a	,, Roll ... ... ,,	£11	...
a	Soda, Chlorate ... ... per lb.	3d.	...
a	,, Crystals ... ... per ton.	£5 to £5 5s.	...
a	Sodium Bichromate, casks ... per lb.	3½d.	...
	METALS, &c.		
b	Aluminium, Ingots ... ... per ton.	£85 to £90	...
b	,, Wire ... ... per lb.	1/1 to 1/9	...
b	,, Sheet ... ... ,,	1/1 to 2/9	...
b	Babbitts Metal and Anti-friction Metals—		
	Grade I ... ... per ton net.	£118	£12 inc.
	Grade II ... ... ,, ,,	£85	£7 inc.
	Grade III ... ... ,, ,,	£52	£4 inc.
c	Brass (rolled metal 2' to 12' basis) per lb.	8d.	½d. inc.
c	,, Tubes (Solid drawn) ... ,,	10d. to 10½d.	...
c	,, Wire, basis ... ... ,,	8½d.	½d. inc.
c	Copper Tubes (solid drawn) ... ,,	11½d.	...
g	,, Bars (best selected) ... per ton.	£77	...
g	,, Sheet ... ... ,,	£77	...
g	,, Rod ... ... ,,	£77	...
d	,, (Electrolytic) Bars ... ,,	£49 17s. 6d.	£6 17s. 6d.dec.
d	,, ,, Sheets... ... ,,	£143 10s.	...
d	,, ,, Wire Rods ... ,,	£59 17s. 6d.	£6 17s. 6d.dec.
d	,, ,, H.C. Wire ... per lb.	7¾d.	¾d. dec.
f	Ebonite Rod... ... ... ,,	2/3 to 2/6	...
f	,, Sheet ... ... ,,	2/3 to 2/6	...
n	German Silver Wire ... ... ,,	2/1	...
h	Gutta-percha, fine... ... ... ,,	nom.	...
h	India-rubber, Para fine ... ... ,,	5½d.	½d. dec.
i	Iron, Pig (Cleveland No. 3.) ... per ton.	63/6	...
l	,, Wire, galve. No. 8, P.O. qual. ,,	£20	...
g	Lead, English pig... ... ... ,,	£16 10s.	...
g	Mercury ... ... per bot.	£22 7s. 6d. to £22 10s.	...
e	Mica (in original cases) small ... per lb.	6d. to 3/-	...
e	,, ,, medium ,,	4/- to 8/-	...
e	,, ,, large ... ,,	10/- to 20/- & up	...
p	Phosphor Bronze, plain castings ,,	1/1½d.	...
p	,, ,, drawn bars & rods ,,	1/1d.	...
p	,, ,, rolled strip & sheet ,,	1/1d.	...
p	,, ,, wire ... ... ,,	1/1½d.	...
o	Platinum ... ... per oz.	£6 15s.	...
d	Silicium Bronze Wire ... ... per lb.	9½d.	...
r	Steel, magnet, in bars ... ... ,,	7½d.	...
g	Tin, Block (English) ... ... per ton.	£120 10s. to £121 10s.	£5 inc.
n	,, Wire, Nos. 1 to 16 ... ... per lb.	2/11d.	...

*For 1 cwt. lots. Special quotations against definite specifications.

Quotations supplied by

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakespeare.
h Edward Till & Co.
i Bolling & Lowe.
l Richard Johnson & Nephew, Ltd.
n P. Orminston & Sons.
o Johnson, Matthey & Co., Ltd.
p C. Clifford & Son, Ltd.
W. F. Dennis & Co.

Reporting on January 3rd, Messrs. James Forster & Co. stated that lead prices hardened a little before the holidays in sympathy with other metals, and at the resumption of business the tone was steady. On the last day of the year, however, the usual support not being forthcoming, prices lost ground to the extent of 5s. per ton, a further decline of 7s. 6d. being seen on January 2nd. As is usual at this time of the year, demand has been negligible, and it was only the firmness in other metals, notably tin, which steadied the markets. The future can hardly be described as bright, but much depends on any revival in consumption and the outcome of negotiations with the miners at Broken Hill. The latest reports state that they have rejected the owners' terms, and should this result in a strike, a different complexion would be put on the position, as about a third of the lead for this market is drawn from that source.

The Norwegian Electrical Manufacturing Industry.

Mr. Per Kure, writing on the situation of the electrical manufacturing industry in Norway, states that on the whole the works producing machines and apparatus were not employed so well in 1930 as in the previous year. No large orders were received from the State or local authorities, but some alterations and extensions were carried out by the electrochemical branch which brought some work to the factories. On the other hand, a certain amount of export trade was carried out, but it was not sufficient, even with the home demand, to exhaust the productive capacity of the works. There was an exception in the case of cooking and heating apparatus, orders for which afforded even and good employment to the makers during the whole of the year.

The Timber Market.

Our Timber Trade Correspondent reports that the demand for European woods has been quiet during the past month, mainly due to the falling-off in building trade operations. Stocks in the country are not large provided that demand gets back to the October-November volume. For some months to come prices generally should be on a much lower level compared with a year ago, as values gradually declined throughout 1930. Hardwoods are in quiet request, but steady in value. High-class merchants hold nice stocks of home, Indian, Australian, African, and other British Empire woods of good value for the money asked. American woods are cheap owing to more being sent over than this market can absorb with ease during these dull times. Plywood stocks also are large and cheaper compared with a year ago.

Lighting and Power Notes.

Aldershot.—SPECIAL ORDERS.—The Aldershot Gas, Water and District Lighting Co., Ltd., has applied to the Electricity Commissioners for a Special Order authorising it to extend its area of supply to include several parishes in the rural districts of Alton, Petersfield, Dorking, Reigate, East Preston and Westhampnett. A Special Order is also being applied for authorising the transfer to the Aldershot Company of the electricity undertaking belonging to the Midhurst and District Electricity Co., Ltd.

Australia.—SYDNEY.—Owing to the falling off in demand for electricity and the likelihood of a large part of the Bunnerong power house becoming idle, the general manager of the Sydney Electricity Department proposes that the new 25,000-kW turbo-alternator, which is still unpacked, should be sold to the Railway Commissioners for installation at the White Bay power station. It is suggested that should the Bunnerong station at any future time have greater demands than it can supply, the Council can always obtain additional energy from the railway undertaking. The Railway Commissioners have greater prospects of increased demand for electricity owing to the schemes for the electrification of some of its long-distance lines and for supplying some of the towns with electricity.

Blackburn.—THE CORPORATION'S PARLIAMENTARY BILL.—With regard to the critical situation which has arisen in Blackburn following opposition to the Corporation's Parliamentary Bill, the Town Clerk recently issued a long explanatory statement in which he stated that the Corporation was seeking power to charge up to 10 per cent. more for electricity supplied outside the borough. Previously, these consumers had been supplied at the same tariff as local consumers, while the losses sustained by the undertaking had fallen entirely on Blackburn ratepayers. The new powers would enable the Corporation to transfer a portion of the losses to consumers outside.

Birmingham.—EXTENSIONS.—To meet the increased demand for electricity supplies, the Birmingham Corporation Electric Supply Committee proposes to make further extensions, and in a report to the City Council recommends that sanction should be obtained to the expenditure of £500,000 upon mains and £200,000 on additions to the sub-station system.

Buckie.—THE ELECTRICITY SCHEME.—The Buckie Electricity Order having now been passed by both Houses of Parliament, the Town Council is to proceed immediately with the introduction of electricity into the town and harbour.

Chile.—NEW POWER STATION.—It is reported from Santiago that the Compania de Traccion y Alumbrado de Santiago is preparing plans for the erection of a new power station on the coast between that city and Valparaiso for the supply of power to the provinces of Aconcagua, Coquimbo, and Atacama. It is proposed to use Chilean coal for the firing of the boilers.

Colchester.—LOANS SANCTIONED.—The Town Council has received sanction to the borrowing of £45,000 for mains extensions and £15,000 for the purchase of domestic electrical appliances.

Continental.—GERMANY.—The report of the Rheinische Westfalische Electrizitätswerk Gesellschaft, of Essen, for the financial year 1929-30 shows that without taking into account the output (328,532,000 kWh) of three affiliated concerns, the Main Kraftwerke, the Zukunft Braun-Kohlen Industrie Gesellschaft and the Paderborn Electricity Supply and Tramways Co., the production of the various power stations amounted to 2,782,147,000 kWh, as compared with 2,067,212,000 kWh in 1928-29, an increase of about 34 per cent. For power purposes the sales advanced from 1,935,259,000 to 2,637,808,000 kWh, and for lighting from 131,953,000 to 144,339,000 kWh. At the end of the year the company had in operation about 2,685 miles of 200- and 100-kV transmission lines.

The Gesfuerel, the public utility company which controls a large number of electricity supply undertakings in Berlin, Munich, Silesia, and other centres, has recommended all its affiliated operating companies to reduce their electricity tariffs. This step has been taken in accordance with the policy of price reduction urged by the German Government, and in expectation of a continued decrease in production costs.

BELGIUM.—According to a recent return the output of electric power in Belgium during 1929 amounted to 4,100 million kWh, as compared with 3,725 million kWh in the preceding year and 1,650 million kWh in 1923. During the period 1923-29 the installed generating capacity in the country increased from 757,000 to 1,663,000 kW.

FRANCE.—According to an article by M. Edgar Micanel, in a recent issue of *La Revue d'Economie Politique*, twenty-four concessions were granted in France during 1929 for the utilisation of water power to the extent of 125,585 kW, as against 12 concessions (75,624 kW) in the preceding year. There are at present 36 hydro-electric plants with a total capacity of 427,700 kW in course of construction in the country. Of these the most important installations are the Kembs plant (80,000 kW), which is being erected on the Rhine by the Société d'Energie Electrique du Rhin; the plants of the Compagnie des Chemins de Fer d'Orleans in the Upper Dordogne Department (total capacity 60,000 kW); the Brommat station (60,000 kW) on the River Truyère, which is being erected by the Société des Forces Motrices de la Truyère; the Courbaisse plant (35,000 h.p.) on the River Tinée of the Société de l'Energie Electrique du Littoral Méditerranean; and the Laval-de-Cere station (25,000 kW), which is approaching completion on the River Cere by the Société Hydro-Electrique de la Cere.

TURKEY.—According to the report for the last financial year, the Société Turque d'Electricité, of Constantinople, was supplying electricity to 55,371 consumers at the end of 1929, an increase of 4,493 during the twelve months. The sales of energy during the year amounted to 66,515,060 kWh, as against 62,243,655 kWh in 1928. In order to be in a position to supply power in Asia Minor, two new 35,000-V submarine cables were laid across the Bosphorus, and a 35,000/10,000-V transforming station was established at Vanikeuy. A 35,000-V transmission line was also erected on the European side between the Silighdar power station and Pera.

ESTHONIA.—A Riga correspondent of a Gothenburg newspaper reports that the English company, the Standard Industrial Trust, Ltd., has applied to the Esthonian Financial Ministry for an option for six months on the utilisation of all the national sources of power in order, during this period, to be able to investigate the possibilities for the electrification of the country. No concession proposal exists. On the other hand, negotiations are said to be proceeding for the grant of a concession for the partial utilisation of the Narva Falls to the Kranholmska Works, in Narva.

CZECHO-SLOVAKIA.—The Ministry of Public Works is preparing a general scheme for the electrification of the country. One of the chief features of the new project is the transformation of certain small regional power stations into large central stations.—*Reuter's Trade Service* (Prague).

Coventry.—MAINS EXTENSIONS.—The Corporation Electricity Committee is applying for sanction to a loan of £1,491 for mains extensions.

Eastbourne.—CHARGES IN RURAL AREAS.—The Rural District Council has arranged with the Corporation that the maximum charge for electricity to be supplied to Pevensey and other areas in the district shall be 9d. per kWh.

Egypt.—DIESEL-ENGINED POWER PLANTS.—Under the direction of the Egyptian Ministry of the Interior two Diesel-engined power stations have recently been completed and put in operation in the towns of Luxor and Keneh, Upper Egypt, which have populations of, respectively, 15,000 and 25,000. The two towns are of considerable historic interest and consequently, in order not to spoil their appearance, the station buildings were executed to the designs of the technical department of the Ministry, after the manner of old Egyptian temples with obelisk-like columns and window frames. The plant of the two stations is practically identical, comprising two three-cylinder Diesel airless-injection engines, each developing 210 h.p. at 250 r.p.m. and a similar engine of 315 h.p. at 214 r.p.m. They are directly-coupled to three-phase alternators generating at 3,150 V. The latter are of the flywheel design, each being provided with its own directly-coupled exciter. Space is available in each machine room for the installation of a further 315-h.p. set as the demand for power supply increases. As required by the Egyptian authorities, the switchboards were provided with coloured scroll work in Egyptian style to the designs of the Ministry. They comprise in the centre four generator panels (for the three existing and one future machines), to the left of which are three panels for the distribution cables to the town and one panel for the power station transformer. To the right of the generator panels are one panel for general metering purposes with two recording instruments, followed by one spare panel, and finally two panels for the transformers serving the adjacent waterworks. The 3-kV switchgear is accommodated in a separate room in which are also located the bus-bars, the oil circuit breakers, isolating links, metering transformers, and the cable connections. The circuit-breakers and the cable connections are placed in separate cubicles closed to access by lattice-work doors. The engines were supplied by the M.A.N. Engineering Co., of Augsburg, Germany, and the generators and electrical equipment by the Siemens-Schuckert Works Co., of Berlin.

Erith.—ELECTRICITY TARIFF REVISIONS.—The Urban District Council Electricity Department has made the following revision in its charges for electricity: Lighting flat rate: 3½d. per kWh. Prepayment lighting: 4d. per kWh. Small power: 1d. per kWh. Domestic heating and cooking flat rate: ¾d. per kWh. Prepayment heating and cooking: ½d. per kWh. Outside and shop-window lighting: 2d. per kWh. No charge is made for meters to prepayment consumers. A concession of 20 per cent. rebate on all existing rebates has also been made to large power consumers with a view to assisting local manufacturers.

Godalming.—TRANSMISSION LINE PROPOSALS.—The Town Council has approved schemes submitted by the Central Electricity Board for the proposed line between Godalming and Hindhead; and also that of the Aldershot Gas, Water, and District Lighting Company for its proposed line between Godalming and Elstead, *via* Milford.

High Wycombe.—REVISION OF ELECTRICITY CHARGES.—The Wycombe (Borough) Electric Light & Power Co., Ltd., has introduced the following new charges for electricity: Two-part domestic tariff: A fixed charge based on floor area, £3 per annum being charged for the first 800 sq. ft., 10s. for each additional 100 sq. ft. up to 1,600 sq. ft., and 7s. for each additional 100 sq. ft. above 1,600 sq. ft.; for every £1 of this fixed charge, 40 kWh of electricity are included, energy consumed in excess of the quantity allowed being charged at 1½d. per kWh. Two-part tariff for shops, &c.: £15 per kW connected, subject to the lighting being adequate, plus 1½d. per kWh. Power for small consumers: First 2,000 kWh per quarter, 3d. per kWh; next 5,000 kWh, 2d.; beyond, 1½d. per kWh. Three years' contract rate: £7 per kW of maximum demand, plus ¾d. per kWh, with a maximum of £100 per annum.

Hull.—NEW PLANT ACCEPTANCE TESTS.—The electrical engineer recently reported to the Electricity Committee that the extensions to the generating station were now almost completed, and in view of the very large expenditure involved he recommended that he be authorised to arrange for an independent expert to carry out the acceptance tests on the plant on behalf of the Corporation. The recommendation was approved, and the engineer asked to make further recommendation to the Committee in due course as to a suitable person to be appointed for the work.

Isle of Man.—DOUGLAS.—The Local Government Board recommends the Tynwald Court to give the Corporation permission to borrow a further £25,000 for the extension of its electricity undertaking.

ONCHAN.—The Manx Tynwald Court has granted the Village Commissioners permission to raise a loan of £800 for converting the street lighting from gas to electricity.

Keighley.—TARIFF REVISIONS.—The Borough Electricity Committee recommends that the scale of quarterly standing charges payable by "point system" consumers shall be amended from April 1st as follows: From 1 to 10 points, 8s.; from 11 to 15 points, 11s.; from 16 to 20 points, 13s.; over 20 points, as existing scale.

Leeds.—CO-ORDINATION OF GAS AND ELECTRICITY DEPARTMENTS.—In an effort to bring about economies, the Corporation has appointed a special joint committee consisting of representatives of the Electricity, Gas, and Finance Committees, to consider ways in which the work of the Electricity and Gas Departments may be co-ordinated.

Lothians.—ELECTRICITY COMPANY'S PROGRESS.—Speaking at the annual supper and dance of the Lothians Electric Power Co., held in Edinburgh, Mr. H. C. Babb said that the company had taken over 9¼ million kWh of electricity from the Portobello station during 1929, which was about 30 per cent. more than in the previous year.

Maidenhead.—CHANGE-OVER.—The Town Council has decided to adopt a.c. distribution in the High Street and Market Street, and application for sanction to a loan of £4,600 has been made to meet a portion of the cost.

Manchester.—ASSISTED WIRING SCHEME.—The Corporation Electricity Committee recommends the introduction of a new assisted wiring scheme for small householders.

Northern Ireland.—BALLYMENA (CO. ANTRIM).—An electric lighting scheme for the town, carried out by the Urban District Council at a cost of £13,000, has now been completed.

Nottingham.—EXTENSIONS.—The Corporation Electricity Committee recommends that application should be made for sanction to a loan of £250,000 for general extension of mains, transformers, switchgear, sub-stations, meters, apparatus for hire and hire-purchase, and for works in connection with the assisted wiring scheme.

Oldham.—LOAN SANCTIONED.—The Town Council has received sanction to a loan of £210,000 for mains, services, meters and domestic appliances.

Preston.—LOAN SANCTIONED.—The Town Council has received sanction to loans amounting to £1,598 for the installation of electric water heaters in 355 houses.

TARIFF REVISIONS.—The Corporation Electricity Committee has increased its home system tariff for consumers outside the borough from 15 to 20 per cent. A slight reduction has been made to motive power users for individual purposes.

SUCCESS OF THE COOKER HIRING SCHEME.—It was stated at a recent meeting of the Town Council that there were 3,600 cookers out on hire at the present, as compared with only four in 1925.

Price Reductions.—Reductions in the charges for electricity have been made or recommended in the following districts:—

BATLEY.—Lighting, from 4½d. to 4d. per kWh. Power, heating, and cooking: A reduction of 5 per cent.

YORK.—A discount of 7½ per cent. is to be allowed on all electricity accounts paid within 14 days, and of 5 per cent. when paid after 14 days, but not later than the 15th day of the month following the rendering of the account.

Shipley.—CHANGE-OVER.—The Urban District Council Electricity Committee is to prepare a scheme for areas to be changed over from d.c. to a.c. during the next twelve months.

Stoke-on-Trent.—LOAN SANCTIONED.—The Corporation Electricity Committee has received sanction to a loan of £20,000 for general services.

United States.—HYDRO-ELECTRIC DEVELOPMENTS.—A new construction programme, involving the expenditure of $28,000,000 (£5,600,000), is to be carried out by the New England Power Association, a subsidiary of the International Hydro-Electric System, states a message from New York. On completion of the programme, which includes the construction of the fourth largest hydro-electric plant in the United States, the Association will have a total hydro-electric capacity of 467,300 h.p., in addition to a thermal plant of approximately the same capacity.

Tramway and Railway Notes.

Australia.—BRISBANE.—A number of special tramcars are being run every Saturday evening starting at intervals between 7.45 and 8 p.m. for a two hours' excursion of the suburbs. The trips vary from 15 to 20 miles in length and the return fare is 6d.

Brighton.—TRAFFIC MERGER REJECTED.—At a poll of the Brighton ratepayers taken on Saturday the local Transport Merger Bill was rejected by 7,994 votes to 7,811.

Continental.—ITALY.—Trials have been made recently of the first electric locomotive built for the Italian State Railways for the haulage of the express trains running between Rome and Florence and between Rome and Naples. The engines have an overall length of 53¼ ft. with a four-wheel bogie at each end. There are six 6¼-ft. driving wheels, each pair of which is driven by twin motors capable of developing a total of 2,000 kW, using 3,000 V d.c. The engine has a total weight of 115 tons, and is capable of attaining a maximum speed of 81¼ m.p.h.

FRANCE.—The work of electrifying the sections of the Midi Railway between Toulouse, Lebourg, and Revel, and between Toulouse and Castres has recently been completed.

SWITZERLAND.—A scheme is under consideration for the electrification of the railway between Solothurn and Munster, and also the line between Bodensee (Lake Constance) and Toggenburg.

Dundee.—PROPOSED PURCHASE OF TRAMWAYS.—The Town Council is again considering the purchase of the tramway system of the Dundee, Broughton Ferry & District Tramways Co., Ltd., and it is understood that the company is willing to negotiate for the sale of the undertaking for a sum not less than £25,000.

Glasgow.—RAILWAY ELECTRIFICATION.—For some years the directors of the London, Midland and Scottish Railway Company have been considering the electrification of the Cathcart Circle, but the *Evening Times* understands that this project has now been abandoned in favour of the more important proposal of establishing an electric train service between Glasgow and Ayr, with branches to all the towns on the Ayrshire coast. The estimated cost of the scheme is approximately £15,000,000.

Irish Free State.—CORK.—The *Electric Railway, 'Bus, and Tramway Journal* states that the directors of the Cork Tramways Co. have decided to abandon the tramway service, and that this decision has been conveyed to the Cork Corporation and Cork County Council.

London.—METROPOLITAN RAILWAY SPEED-UP.—The work of doubling the Metropolitan Railway line between Wembley Park and Harrow is nearing completion, and the *Morning Post* states that it is expected that the new track will be opened in the spring. At present, from Wembley northwards, there is only the ordinary double track to carry the passenger traffic to the new residential districts, and the duplication will enable the company to use two tracks for slow trains and two for fast. Northwick Park station, which is of comparatively recent construction, and Preston Road station, are being remodelled to meet the new conditions, and the widening of the system has necessitated the building of five bridges and the widening of several others.

Merivale Light Railways.—EXTENSION OF TIME.—The Minister of Transport has extended until March 14th next the period for the completion of the light railways authorised under the Merivale Light Railways Order.

Portuguese East Africa.—LOURENCO MARQUES.—The tramway system of Lourenço Marques is to be abandoned owing to the losses caused by omnibus competition.

Preston.—RAILLESS CARS.—A further stage in Preston Corporation's Parliamentary Bill was reached when a recent meeting of ratepayers passed the formal resolution by 44 votes to 23. The Bill provides, *inter alia*, for the running of railless cars and the borrowing of £28,000 for the conversion of track.

Salford.—THE TRAMWAY LOSSES.—The Corporation Transport Committee has decided to defer for three months consideration of methods of reducing the loss on the tramway undertaking. For 1929-30 there was a net deficiency of £18,789, as compared with a net surplus of £13,851 in the preceding year.

Southern Railway.—ELECTRIFICATION OF BRIGHTON LINE.—Some of the electrical energy required by the Southern Railway for the extension of its electrified system to Brighton is to be purchased from the Croydon Corporation.

Wigan.—TRAMWAY ABANDONMENT.—The Corporation has applied to the Minister of Transport for permission to substitute 'buses on several routes now served by tramcars.

Telegraph and Telephone Notes.

Bermuda.—TELEPHONE SERVICE.—Application has been made by the American Telephone and Telegraph Company to the U.S. Federal Radio Commission for a construction permit to erect stations for a short-wave wireless telephone service between the United States and the Bermuda Islands, the service in Bermuda to be handled by Imperial & International Communications, Ltd., working in conjunction with the Bermuda Telephone Company.—*Reuter* (New York).

China.—TELEGRAPH ADMINISTRATION.—The Chinese Telegraph Administration and the Commercial Pacific Cable Company have reached an agreement whereby the National Government has granted to the company the renewal of its landing licence in China for fourteen years as from January 1st, subject to certain revisions of the agreement. It is understood that the Ministry of Communications is to have an equal voice with the cable company in the relations of the Shanghai offices of the company (the only one in China) with the public, while the technical operation of the cables is to remain in the hands of the company. It is understood that the Great Northern Telegraph Company and the Eastern Extension Telegraph Company have signed somewhat similar agreements at Nanking after exceedingly protracted and delicate negotiations. —*Reuter* (Nanking).

Jugo-Slavia.—TELEPHONY.—It is stated that the Siemens and Halske Company, the Felten and Guilleaume Company, and the Standard Elektrizitats Gesellschaft have submitted a joint offer to the Government of Jugo-Slavia for the construction of a long-distance telephone network in that country at a cost of 12,000,000 dollars, together with telephone exchanges. The work would occupy a period of seven years and a credit of twelve years is said to be under consideration. The Standard Elektrizitats Gesellschaft was formed jointly by the International Telephone and Telegraph Corporation and the Berlin A.E.G.

Rumania.—TELEPHONE CONCESSION.—On January 2nd the International Telephone and Telegraph Corporation, through its subsidiary Societatea Anonima Romana de Telefoane, purchased the national telephone system for approximately 4,500,000 dollars. The system comprises more than 5,000 telephone stations and long-distance lines between all cities. Under its contract with the Ministry of Communications the Corporation must furnish automatic service in 13 of the most important cities and intends to rebuild the entire system. The new company has already purchased a site for its general office building and another subsidiary, the Standard Electrica Romana, has been organised to manufacture equipment locally, the factory land having already been purchased.

The Telephone Service.—NEW LONDON EXCHANGE.—The new Gulliver automatic exchange in Kentish Town Road, London, was opened on January 1st, when 1,300 subscribers on

the Hampstead exchange were switched over. Eventually this exchange will absorb Mountview and North. Other exchanges which will become automatic in the course of the year include Whitehall (to relieve Victoria, Gerrard and Regent), Gladstone (Cricklewood), Leytonstone, Ewell, Purley, Sanderstead, Downland near Purley and Acorn (Acton) to relieve the Chiswick and Ealing areas.

International Telephony.—LATVIA.—Arrangements have recently been completed for the establishment of telephone communication between Latvia and Denmark, *via* Estonia, Finland, and Sweden.

Transatlantic Telephony.—SERVICE EXTENSION.—As from January 1st the service from Britain was extended to all parts of Canada and Mexico, instead of being limited to the principal towns only. The service is thus now available to the whole of North America, including Cuba.

Venezuela.—CABLE RATES.—As from January 1st the cable telegraph rates to South America were reduced by Imperial and International Communications, Ltd.

SUBMARINE CABLES.—It is reported that the American company which recently took over the French Cable Company in Venezuela, is laying a new connecting submarine cable between La Guaira, Curaçao, Aruba, Maracaibo, Baranquilla, and Bonaire.

Radio Notes.

Australia.—NEW STATIONS.—A recent Senate statement reveals the fact that, although the Government had decided to erect five new A Class broadcasting stations, only four will be constructed. Financial stringency is given as the reason. They will be built at Rockhampton (Q.), Newcastle (N.S.W.), Corowa (N.S.W.), and Crystal Brook (S.A.). The fifth station was to have been in the south-west of West Australia.

Belgium.—INTERFERENCE LAW.—The town of Dinant has passed legislation to compel every user of electrical apparatus to take whatever steps might be necessary to prevent interference with the reception of wireless sets in the neighbourhood. According to *World Radio*, Dinant is the third Belgian town at least to pass legislation to this effect.

Germany.—NEW STATIONS.—The German Post Office has decided to proceed with the construction of nine high-power stations. Two are already in existence at Mühlacker, in South Germany, and Heilsberg, in East Prussia. The next to be brought into service will probably be Langenberg, in the Rhineland, where the power of the existing high-power station is to be increased before the autumn. The remaining six stations will be situated at or near Breslau, Leipzig, Berlin, Hamburg, Munich, and Frankfort-on-Main. They will replace the main stations of the present German regional system, the two most powerful of which, Langenberg and Gleiwitz, have aerial powers of 17 kW and 5.6 kW, respectively. The national station at Königs Wusterhausen (the "Deutschlandsender") has a power of 35 kW. The new stations will take over the wave-lengths of the present main stations. Parallel systems of low-power stations, working on common wavelengths, will also be created, according to *The Times*, in North Germany, South-west Germany, and Bavaria. The new high-power stations will have an average aerial transmitting power, on the international reckoning, of 60 kW, but in the case of the East Prussian station at Heilsberg it is expected that the proximity of other high-power stations will necessitate more than 60 kW. The building of high-power stations in neighbouring countries is in fact the principal reason given by the Reichspost for the entire scheme.

Regional Interference.—WAVELENGTH CHANGE.—A B.B.C. experiment was carried out on December 30th in an endeavour to find a means of reducing the interference which is caused to the London regional transmitter by the new German transmitter near Stuttgart. During the whole of that day the London regional transmitter exchanged wavelengths with Graz and worked on 352.3 instead of 356.3 metres. The experiment was made possible by the courtesy of the Austrian broadcasting authorities, but it was not satisfactory from the point of view of the Austrian listener. The Austrian Broadcasting Company accordingly informed the British Broadcasting Corporation that it would be quite impossible to consider making the temporary interchange of wave-lengths permanent.—*Reuter* (Vienna).

Russia.—NEW STATIONS.—According to the official *Izvestia*, plans have been completed for the construction of powerful stations at important centres of the component republics of the Soviet Union. It is proposed to erect 11 stations of 100 kilowatts and 38 stations of 10 kilowatts, the construction of which is to be finished by the end of the Five-year Plan. To a 500-kilowatt station at Noginsk, near Moscow, will be added a short-wave 60-kilowatt station. The total cost is estimated at 90,000,000 roubles (nominally £9,000,000). At present the finishing touches are being given to the new station of 75 to 100 kilowatts, at Kolpino, near Leningrad, which, says *The Times*, will soon begin functioning.

Contract Information.

When "Contracts Open" are advertised in our "Official Notice" pages, the date of the ELECTRICAL REVIEW containing the advertisement is given in parentheses below

Contracts Open.

Australia.—MELBOURNE.—Posts and Telegraphs Department. February 5rd. Telephone exchange power boards. (A.X. 10466.)*

February 10th. Telephonists' telephones for common battery working. (A.X. 10569.)*

February 17th. Electric lamps, lamp caps and sockets for voltages from 4 to 50. (A.X. 10643.)*

February 24th. Resistances in vitreous spools ranging from 100 to 4,000 ohms. (A.X. 10642.)*

March 17th. 80 miles of rubber-insulated, cotton-covered twisted conductors. (A.X. 10697.)*

Belgium.—BRUSSELS.—January 21st. Belgian Telegraph and Telephone Department. Supply and laying of telephone cables in the Antwerp, Herve, Forville, and Ciney districts.

Bridlington.—January 19th. Corporation. 11-kV and l.p. cables, boxes, and roadwork; also 11-kV ring-main switchgear, transformers, and equipment. (December 19th.)

Dundee.—February 11th. Electricity Department. 4-ton, overhead, travelling hand crane. (See this issue.)

Egypt. — CAIRO. — February 23rd. Ministry of Public Works. Generating, distributing, and pumping plant for Naga Hamadi barrage. (A.X. 10664.)*

SAMANOND.—February 28th. Ministry of the Interior. February 28th. Supply and installation of an electrical distribution system for the town. (A.X. 10659.)*

Halifax.—January 21st. Wiring of 114 houses to be erected by the Corporation. Specification from Mr. A. C. Tipple, borough engineer, Crossley Street (deposit £1 1s.).

Hull.—January 19th. Corporation Electricity Department. Electric lamp-posts and brackets for street lighting. (December 12th.)

Liverpool.—January 22nd. Electricity Supply Department. Twelve months' supply of materials. (January 2nd.)

London.—ISLINGTON.—January 16th. Borough Council. Twelve months' supply of electrical and engineers' stores. (December 12th.)

COUNTY OF LONDON ELECTRIC SUPPLY CO., LTD.—February 2nd. Coal-unloading cranes and coal-handling plant, including travelling bridge and belt conveyors, in connection with the Barking power station extensions. (December 12th.)

February 9th. Main, auxiliary and multi-core cables and accessories for connections between the new and existing switch houses at Barking power station. (See this issue.)

CENTRAL ELECTRICITY BOARD.—January 19th. Construction of site works, foundation works, and buildings in connection with the North-East England Electricity Scheme. (December 12th.)

February 2nd. 132,000-V transformers. (January 2nd.)

February 9th. Construction of site works, foundation works and buildings at Wigan and Southport in connection with the North-West England and North Wales Electricity Scheme. (See this issue.)

OFFICE OF WORKS.—January 27th. Wiring of residences and road lamp standards at Broadmoor Asylum, Crowthorne, Berks. (See this issue.)

L.C.C.—January 30th. Electrically-driven sewing machines at Joyce Green Hospital, Dartford. (See this issue.)

New Zealand.—WELLINGTON.—Public Works Department. February 24th. One set of 110-kVA outdoor switchgear, steelwork and controlling equipment. (A.X. 10507.)*

Northern Ireland.—BELFAST.—February 14th. Electricity Department. Steam boiler plant. (See this issue.)

Portsmouth. — February 2nd. Tramways Department. General stores for twelve months. (See this issue.)

Smethwick.—January 31st. Education Committee. Low-pressure water heating of the Holly Lodge High School. (January 2nd.)

South Africa.—JOHANNESBURG.—Railways and Harbours. February 2nd. Two 150-kW convertors. (A.X. 10668.)*
February 16th. Material for colour light railway signalling. (A.X. 10662.)*
January 29th. City Council. Electrical instruments. (A.X. 10690.)*
DURBAN.—February 20th. Corporation. Traffic control signals. (A.X. 10687.)*
CAPE TOWN.—January 22nd. City Electricity Department. Induction voltage regulators. (A.X. 10689.)*

Southend-on-Sea.—January 21st. Electricity Department. General stores for 12 months. (December 19th.)

Staffordshire.—February 3rd. Education Committee. Installation of electric lighting in several school buildings. (January 2nd.)

* Further particulars can be obtained at the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, S.W.1

Contracts Closed.

Birkenhead.—Electricity Committee. Accepted :—
L.p. cable for 12 months.—W. T. Glover & Co., Ltd.; Hackbridge Cable Co., Ltd.; Macintosh Cable Co., Ltd.

Bristol.—Bristol Tramways and Carriage Co. Accepted :—
Two miles of "Phono" electric trolley wire.—Equipment and Engineering Co., Ltd.

Dublin.—Port and Docks Board. Accepted :—
12 months' supply of electric lamps of all types.—Siemens Electric Lamps & Supplies, Ltd.
Dublin United Tramways Co. (1896), Ltd. Accepted :—
12 months' supply of electric lamps.—Siemens Electric Lamps & Supplies, Ltd.

Eastbourne.—Electricity Committee. Accepted :—
Meters (£1,725).—Electrical Apparatus Co., Ltd.
Electricity Committee. Accepted :—
Wiring under assisted scheme.—Braine & Parris.

Leicester.—Tramways Committee. Accepted :—
Steel girder tramway rails and fish plates (£2,252).—Dorman Long & Co., Ltd.
Points, crossings and fish-plates (£578).—Hadfields, Ltd.

Newport Pagnell.—Rural District Council. Accepted :—
Installation of electric lighting in ten houses at Sherington.—F. E. Williamson.

Salford.—Electricity Committee. Accepted :—
"Unity" electric heating system at electricity works, Frederick Road, Pendleton (£150).—Young, Osmond and Young, Ltd.

Sheffield.—City Hall Committee. Accepted :—
Material (exclusive of fittings) for electrical installation at City Hall (£3,759).—Grierson, Ltd.

Smethwick.—Health Committee. Accepted :—
X-ray apparatus for new clinic (£627).—L. G. Coade & Co.
Watch Committee. Recommended :—
Installation of electric lighting at Law Courts (£299).—Walker & Co.
Education Committee. Accepted :—
Electric lighting of Uplands School (£1,800).—Walker and Co.

York.—Electricity Committee. Recommended :—
Two switch panels (£1,952) and transformers (£1,457).—Metropolitan-Vickers Electrical Co., Ltd.
Accepted :—
Provision and laying of underground h.p. cables (£4,640).—Callender's Cable & Construction Co., Ltd.
Provision and erection of h.p. and l.p. overhead lines (£17,473).—Johnson & Phillips, Ltd.

Forthcoming Events.

Institution of Electrical Engineers.—Monday, January 12th. Institution, London. 7 p.m. Informal meeting. Discussion on "The Packing and Transport of Electrical and Allied Machinery." Opened by Mr. J. F. Shipley.
(London Students' Section).—Friday, January 9th. Institution, London. 6.15 p.m. "Mercury Arc Rectifiers." Messrs. A. Dean and M. M. MacMaster. Wednesday, January 14th. 2.15 p.m. Visit to the Osram Lamp Works of the General Electric Co., Ltd., Hammersmith.
(North-Eastern Centre).—Monday, January 12th. Armstrong College, Newcastle-on-Tyne. 7 p.m. "The Distribution of Energy Liberated in an Oil Circuit Breaker; with a Contribution to the Study of the Arc Temperature." (Electrical Research Association Report.) Mr. C. E. R. Bruce.
(North Midland Centre).—Tuesday, January 13th. Hotel Metropole, Leeds. 7 p.m. "Surge Investigations on Overhead Line and Cable Systems." Messrs. S. W. Melsom, A. N. Arman and W. Bibby.
(Scottish Centre).—Tuesday, January 13th. Institution of Engineers and Shipbuilders, Glasgow. 7.30 p.m. "Loud-speakers since their Conception with Gramophone Pick-ups and Wireless Recording Apparatus." Mr. S. G. Brown.
(North-Western Students' Section).—Tuesday, January 13th. Engineers' Club, Manchester. 7.15 p.m. "Electric Traction." Lt.-Col. H. E. O'Brien.
(Hampshire Sub-Centre).—Wednesday, January 14th. Municipal College, Portsmouth. 7.30 p.m. Short papers.
(North-Eastern Students' Section).—Friday, January 16th. Armstrong College, Newcastle-on-Tyne. 7.15 p.m. "Transformers." W. T. Tracey. Saturday, January 17th. Visit to North-East Marine Works, Walker-on-Tyne.

Association of Mining Electrical Engineers (South Wales Branch).—Saturday, January 10th. South Wales Institute of Engineers, Cardiff. 6 p.m. "The Earthing of Electrical Apparatus." Mr. J. Vaughan Harries.

Electrical Power Engineers' Association (London Local Group).—Tuesday, January 13th. Junior Institution of Engineers, London. 7.15 p.m. "The Dismantling, Transportation and Erection of Heavy Machinery." Mr. N. E. Box.
(Manchester Group).—Wednesday, January 14th. College of Technology, Manchester. 7.15 p.m. "The Life and Work of Dr. Ferranti." Mr. F. Bailey.

Institute of Marine Engineers.—Tuesday, January 13th. Institute, London. 6 p.m. "The Electrical Equipment of a Modern Ship." Mr. J. E. Allan.

Edinburgh Electrical Society.—Wednesday, January 14th. 16, Royal Terrace, Edinburgh. "Automatic Telephones." Dr. T. H. Turney.

Electrical Society of Glasgow.—Wednesday, January 14th. Visit to the Works of the Craigpark Electric Cable Co., Ltd.

Overhead Lines Association.—Wednesday, January 14th. Institution of Electrical Engineers, London. 5.30 p.m. Discussion continued on Overhead Line Regulations.

Electrical Trades' Benevolent Association.—Wednesday, January 14th. Scala Theatre, London. 8 p.m. "Baa! Baa! Black Sheep." Presented by the Bouverie Players.

Television Society.—Wednesday, January 14th. University College, Gower Street, W.C. 7 p.m. Short papers on "Television Progress in Europe and America during 1930."

Physical Society.—Friday, January 16th. Imperial College of Science, South Kensington. 5 p.m. Short papers.

British Electrical Development Association.—Friday, January 16th. Royal Society of Arts, London. 7.30 p.m. Salemanship Conference. "Eda Electric Homes (Outlet) Campaign (Second Period)." Mr. V. W. Dale.

Junior Institution of Engineers.—Friday, January 16th. Institution, London. 7.30 p.m. "Some Problems Surrounding the Re-organisation of an Engineering Works." Mr. K. W. Willans.

The "Electrical Review" Service Department.

INQUIRIES must be accompanied by a stamped addressed envelope.

We shall be glad to learn the names and addresses of makers of the following devices :—

ARDWICK battery chargers.

We also have an inquiry for firms who will undertake colour-spraying of electric lamps. Must be permanent.

CELSIO vacuum cleaners.

Large Hydro Turbine.

What is claimed to be the largest water turbine in the world has just been completed at the works of Escher Wyss and Co., Zurich. It is the first of four which are being built for the Ryburg-Schworstadt hydro-electric power station on the Rhine, and is of 30,000-40,000 h.p. capacity. Of the remaining three turbines, one is being constructed by the Ateliers de Charmilles, Geneva, and two by the Voith Engineering Works, Heidenheim, Germany.

Notes.

Electrical Heating of Buildings.

A special course of six lectures, together with demonstrations, on the above subject, with particular reference to the equipment at the new Polytechnic extension, will be given on Wednesday evenings at 7.30, commencing on January 21st. A description of the electrode-boiler heating installation was given in the ELECTRICAL REVIEW of April 4th, 1930. These lectures are intended for electrical students, power and heating engineers, builders, and others interested in the newer forms of building heating. As only a few persons can be accommodated at a time, immediate application should be made by those wishing to attend any of the demonstrations, which will be held following all but the first lecture.—(See our advertisement pages to-day.)

"Baa! Baa! Black Sheep."

This is a final reminder that the Bouverie Players are presenting the farcical comedy named above (by P. G. Wodehouse & Ian Hay) in aid of the funds of the Electrical Trades Benevolent Institution at the Scala Theatre, W., on Wednesday next, January 14th. There are still plenty of seats available—too many in fact—and we ask members of the industry to afford whatever support they can to this very laudable effort. It may be said that in addition to aiding a good cause, those who attend the performance will receive good value for their money.

It is suggested that firms might take blocks of seats for members of their staffs, or, at least, obtain a few tickets and endeavour to sell them. The prices of seats, tickets for which can be obtained from the Secretary of the E.T.B.I., Capt. J. T. Keeping, M.C., 9, Southampton Street, W.C.1, or from the Play Manager, the *Electrician*, Bouverie House, Fleet Street, E.C.4, are as follows:—Fauteuils or dress circle, 10s. 6d.; orchestra stalls, 7s. 6d.; stalls, 5s. 9d.; grand circle or pit stalls, 3s. 6d.; and upper circle, 1s. 2d.

Appointments Vacant.

Engineer-surveyor for overhead-line construction for Torquay Electricity Department.

Assistant traffic superintendents in London Telephone Service and in the provinces for the Civil Service Commission.

Engineering assistant for the Municipal Tramways and Transport Association.

Change of frequency engineer for West Hartlepool Corporation.

(See our advertisement pages to-day.)

Electric Vehicles in France.

In order to encourage the use of electric vehicles in France a Bill has lately been introduced in the French Parliament under which it is proposed to reduce the annual taxes on such vehicles to 50 per cent. of the standard rates. Such a concession has been granted since the end of 1926 to motor vehicles driven by gas obtained from self-contained apparatus, and it is urged that a similar concession should be extended to electric vehicles in view of the reduction in the dependability on imported liquid fuel their extended use would bring about.

Battery 'Buses in Belgium.

A company has been formed in Brussels, the Société Belge de Traction Electrique par Accumulateurs, for the development of accumulator traction; its sponsors have been directors of Belgian power companies.

Its first major venture was the provision of several 'buses

A Battery 'Bus.

for connecting the two parts of the exhibition which was held last summer at Liège.

The 'bus is carried on two axles, with a spacing of about 17 ft.; the main frames are 30 ft. long. The battery is hung on a subsidiary frame, so arranged that either 21 lead or 36 ferro-nickel cells can be used. The 'bus seats 32 persons comfortably, and has separate standing room for 18 more; there are two entrances—a desirable feature. Two motors are used, each of 24 h.p., on an hourly basis at 900 r.p.m. Control is of the series-parallel type, with an emergency rheostatic brake; the controller is operated by means of foot pedals, one to start and the other to return to the off position. On a good level road, with a battery of 1.6 tons and a total weight of 12 tons, the operating radius per charge is about 50 miles; the top speed is about 23 miles per hour. The consumption of energy metered, before conversion to d.c. for charging, works out at about 3 kWh per mile. Those operating the 'bus consider that the absence of reciprocating stresses and the smooth starting, as compared with the sudden clutch starting with the petrol 'bus, must have a material effect on the maintenance of the chassis and tires. The car is fitted with a bumper, and a pocket is arranged for a spare tire below the operating platform.

It is obvious that the denser the traffic the greater the advantage for accumulator traction, as no power is consumed during checks, and the energy required for starting is reduced. The 'buses are nicely fitted up and run very smoothly.

Fatality.

An inquest was held at North Shields on December 30th on William Robert Chambers, who received a fatal electric shock when washing out the backyard of his home. It was stated that he had erected an electric light in the yard to facilitate his work, a connection being made to a socket in the bathroom. Mr. C. Turnbull, electrical engineer to the Tynemouth Borough Council, said that in the completion of the terminals of the lamp which the deceased was using, a piece of solder had come into contact with the outer case, thus making the holder "alive." A verdict of "Accidental death" was returned.

The Electrical Association for Women.

The Association's London fixtures for the spring session include: January 15th, 3 p.m., new year social at 46, Kensington Court (tickets 1s. 6d., non-members 2s.); January 29th, 3 p.m., practical lecture for the housewife on "Simple Household Repairs" (fuses, flexible cords, &c.), by Mr. H. Bourne, 46, Kensington Court; February 11th, 3 p.m., visit to West Ham new electricity offices and showrooms, where a short talk on "The Progress of Electricity in West Ham" will be given by Mr. J. W. Townley, A.M.I.E.E., engineer and manager, West Ham electricity undertaking; February 24th, visit to London County Council tramway depôt, Effra Road, Brixton, and drivers' training school, Clapham (a special tram will leave the Embankment opposite Charing Cross Underground Station at 2 p.m. prompt); March 4th, 3 p.m., "At Home" at 46, Kensington Court, with a talk on "Some American Experiences," by Miss A. A. Stemp (tickets 1s. 6d., non-members 2s.); March 24th (and provisionally March 25th), visit to the works at Luton of the Jackson Electric Stove Co., Ltd., where a short talk will be given on "The Construction and Management of the Modern Electric Cooker": April 17th, one-day conference and ball in London.

Industrial Electric Heating Lectures.

We have received from Lt.-Col. W. A. Vignoles, director, Electrical Development Association, a copy of his report on a course of lectures on industrial electric heating which was held at the Lighting Service Bureau, London, on October 23rd and 24th last. On the first day the proceedings opened with an address by the director, in which he set out the objects of the course and laid stress on the wide field available for the development of electrical industrial heating in almost every industry. Following his opening remarks, Col. Vignoles read two specialised papers, the first dealing with small industrial applications, and the second with ovens for temperatures up to 1,000 deg. F.; detailed technical information for both these addresses was supplied by Dr. T. Settle. The Thursday afternoon was devoted to works.

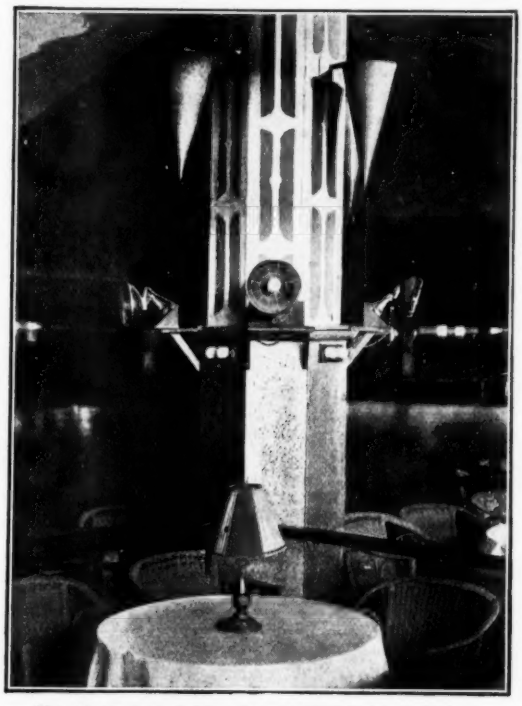
The second day opened with a paper on "Furnaces for Temperatures up to 1,000 deg. C.," by Mr. E. P. Barfield, read by Mr. R. L. Acland. A second paper by Mr. W. S. Gifford on "Metal Melting Furnaces" was also read by Mr. Acland. These two papers seemed to impress the delegates with the great possibilities of electrical heating in the heavier industries, and the fact that so much progress had been made in its adoption. The afternoon was devoted to two papers, namely, "Heating Large Buildings," by Mr. C. G. Nobbs, and "Steam Raising for Commercial Purposes," by Commander F. J. Campbell Allen, both being read by Mr. Acland. All the papers were illustrated by lantern slides. Saturday morning was also devoted to visits to works.

The general impression gained from conversation with the various delegates is that those attending were pleased with the course, and were evidently impressed with the demonstration of the great advance that has been made with industrial heating; delegates also appeared to feel that they had received considerable help from the suggestions that had been made to them during the course as to the best method of seeking out and cultivating the electrical industrial heating load. It is hoped that arrangements may be made to hold similar courses in other parts of the country this year.

A Novel Heating Installation.

We have received from Hecla Electrics (Sydney), Ltd., Sydney, Australia, the following notes and illustration concerning a large electric heating installation which they have carried out. The Palais Royal, situated at Moore Park, Sydney, has a floor area available for dancing of 20,000 sq. ft., and a total single-floor area under one roof of 60,000 sq. ft.,

and it is claimed to represent the largest area electrically heated in the Southern Hemisphere. A wide promenade surrounds entirely the four inner walls, and running parallel to the promenade are slightly raised platforms, in the centre of which stand the twenty-nine main roof-bearing pillars. The dancing area is inside the platforms. The method adopted to heat this vast area was to erect on the pillars at 6.5 ft. above the floor level angle brackets carrying one-kW radiant, copper-reflector "Hecla" heaters. In all twenty-nine pillars were available, and to each of twenty-eight of these four radiators were attached. To the remaining pillar two radiators have been fixed, giving a total loading of 114 kW. Each radiator is separately switch-controlled, the switches normally being left in the "on" position, enabling the entire installation to be switched on from the main board in the switch-room, and affording facilities for the radiators to be switched off according to the requirements of the individual visitors. The method adopted has proved highly successful and satisfactory, and in addition to providing heat throughout the whole area, the radiant glow of the cones adds materially to the attractiveness of the decorative scheme in the main. In addition to the current utilised for heating purposes, the Palais Royal contains 5,700 internal decorative lighting points, added to which there are 2,700 lighting points exterior to the building, giving a total load of 275 A per phase on the three-phase 240-V supply.



Heating Arrangements Around One Pillar in Palais Royal.

Installations in Chromium-plating Works.

Wiring for power, light and signal systems in chromium-plating plants must be kept free from injury by acid fumes and vapours, as the deposition of the lustrous metal is attended with copious evolution of gases which provoke a spray of chromic acid. Fume ducts and fans are invariably applied to remove the corrosive atmosphere; nevertheless sole dependence cannot be placed on the ventilation scheme. Natural circulation of the air in conjunction with door and window openings abetted by walls and partitions is stated in the *Electrical World* to result in the corrosive agent being carried to vulnerable objects. Even though the air be only weakly corrosive, the cumulative effect may be disastrous.

Present systems should receive increased protection, and new systems should be carefully laid out in contemplation of the hazard. Vapour-proof fittings, fixtures, wall-switch covers plug-receptacle covers, and similar appurtenances are essential to prevent the fumes reaching the brass and copper parts. Galvanised conduit with enamel coatings should suffice to protect the wiring and ducts. Gaskets should be used with plug boxes to seal cover joints. Cabinets should in general be placed where they will not be reached by the fumes.

It is unfortunate that so welcome an innovation as chromium should entail so destructive an accompaniment as the acid vapours emitted in the plating process. With care and foresight, however, protection that will assure prolonged life and service can be given to the peculiarly susceptible metals employed generally in electrical circuits and devices.

In planning for the heating of the control building of Howard sub-station of the Ohio Power Company at Vernon, Ohio, it was decided to utilise the heat losses of the 15,000-kVA, three-phase, 11,500-V outdoor type of synchronous condenser. According to the *Electrical World* air is taken through louvres in a small brick structure immediately adjacent to the condenser installation and, after filtering for dust and excess moisture, is passed through the machine and thence through underground ducts to the control building, where it is distributed as needed. So satisfactory has the arrangement proved that another heating system installed for possible use when needed has very seldom had to be placed in operation in even the coldest weather. The 300-kW heat losses unavoidably produced by the 15,000-kVA machine in normal operation have fully taken care of the situation.

X-rays and Tuberculosis.

X-rays can find early signs of tuberculosis of the lungs, even before the victim appears to be ill, it is stated in *Science*.

Tuberculosis of the lungs may be present for months and even years before there are definite symptoms, and an adolescent child may be apparently healthy, physically active, and even overweight, and yet may have tuberculosis in a serious form. X-ray examination is very valuable in such cases, as evidences of tuberculosis are found on X-ray plates in its early stages.

X-ray plates indicate the progress of tuberculosis. They are valuable as permanent records, and also for making comparisons of X-ray plates recently taken with plates taken three or six months before. When tuberculosis of the lungs grows worse the shadows on the X-ray plates grow larger, or evidences of cavities may appear.

If there is improvement, the shadows gradually grow smaller, but never disappear entirely, even if the patient completely regains his health, as scars due to tuberculosis of the lungs remain throughout life. The shadows caused by pneumonia disappear in a few days or weeks, and they leave no scars.

Heat Transfer.

The transfer of heat from one fluid to another across an intervening metal plate is of such importance to engineers concerned with the design and operation of such apparatus as surface condensers, feed-water heaters, and similar auxiliaries, that the British Electrical and Allied Industries Research Association formed a committee of prominent engineers, experienced in condenser design, with Messrs. Albert Eagle, B.Sc., and R. M. Ferguson, M.Sc., as investigators, to inquire into the problem and the present state of knowledge of the subject. An exhaustive survey was first made of all relevant published articles on heat transfer, but it was found impossible to deduce any general rule by which one could predict what the coefficient of heat transfer would be under any given conditions. Various independent experiments had been carried out, but the conclusions from the different sources could not be made to harmonise. For these and other reasons it was decided to conduct new research with the object of determining as fully as possible the way in which the coefficient of heat transfer varies with the physical properties of the fluids employed. The research in the first instance was confined to determining the phenomena on the water side of a condenser tube. In this investigation several important factors were brought to light, and the committee, with the consent of the Association, recently brought them to the attention of members of the Institution of Mechanical Engineers in the form of a paper entitled "The Coefficients of Heat Transfer from Tube to Water" (being report, ref. H/T16, of the British Electrical and Allied Industries Research Association). Various advantages resulted from heating the investigational tube electrically by passing low-voltage a.c. through it.

Oil-engines' Waste Heat.

Waste-heat recovery from internal-combustion engines, with particular reference to marine oil engines, is the subject of Major W. Gregson's recent Diesel Engine Users' Association paper. The oil engine rejects heat in the cooling water and the exhaust gases. Any economic method of utilising that otherwise wasted heat can be credited to the engine as an addition to the useful work carried out by its normal functions. In approximate figures, over 60 per cent. of the heat energy in the fuel is lost through these two sources, the slightly larger fraction of the two being lost with the cooling water, which leaves the engine at a reasonably low temperature; hence, owing to the highly diluted state of this heat, the latter is very difficult to recuperate. Occasionally, if the cooling water is reasonably pure and fresh, a fraction can be used as warm feed for a waste-heat boiler utilising the exhaust gases. It is sometimes used as first stage heating for (say) a factory-heating proposition, but on board ship recovery is largely confined to the utilisation of the exhaust-gas heat, effected either by generating steam or by heating water. Some 20 per cent. of the total heat in the original fuel appears as heat in the exhaust gases. Owing to the increased over-all efficiency the electric auxiliary is becoming more and more popular on motorships, particularly on services where the deck auxiliaries are in use at frequent intervals, and, therefore, show a good return on the increased capital cost of electrical gear. When waste-heat recovery is not practised it is usual to rely on Diesel generating sets for power, but when steam is available from waste heat it would appear to be sound economics to replace, say, one generating set by a steam set, using the exhaust steam for the accommodation heating services, with suitable calorifiers.

&c. This gives a very high over-all efficiency, and with a cargo ship, or average-sized passenger, or cargo ship operating on 4-stroke engines, there should be no difficulty in maintaining sea services in this way, with a stand-by Diesel set for port use. By oil-firing the waste-heat boiler in port a port stand-by to the Diesel set is arranged for. Mention should be made of the special design which utilises the Diesel engine waste heat for increasing the power of the main engine, *i.e.*, the Still engine. Full advantage is taken of the cooling water as feed by running to much higher temperatures (with less actual quantity circulating), plus recovery on the waste-gas side, the resultant steam being used in a combination i.c. and steam engine. Another system which has been suggested is to use electric power generated from the waste-heat steam for augmenting the main engine by means of a motor on the main shaft, but, having in view the necessity in any case for catering for the auxiliaries, the latter would appear to be the sounder proposition taking everything into consideration.

S.W. & S. Power Co. Fined.

AT the Halesowen Police Court recently, the Shropshire, Worcestershire & Staffordshire Power Co. was summoned for breaches of the electricity regulations under the Factory and Workshop Act. It was stated for the prosecution that an employé of the company named Johnson was instructed, on August 31st last, to clean some insulators on a switchboard in the company's Halesowen sub-station. The whole of the board should have been made "dead" or protective screens should have been provided. The section upon which Johnson was working had been rendered "dead," but in the course of his work he went beyond this section and received a shock at 33,000 V; he died from the effects of this two days later.

For the defence, it was stated that although the company admitted that the whole of the switchboard in question was not made "dead," it did so arrange that the work could be carried out without danger. The man must have left the ladder upon which he was working, which the prosecution had agreed was unnecessary.

After consultation the magistrates imposed fines totalling £11 but refused to allow the prosecution costs. They agreed, however, to state a case.

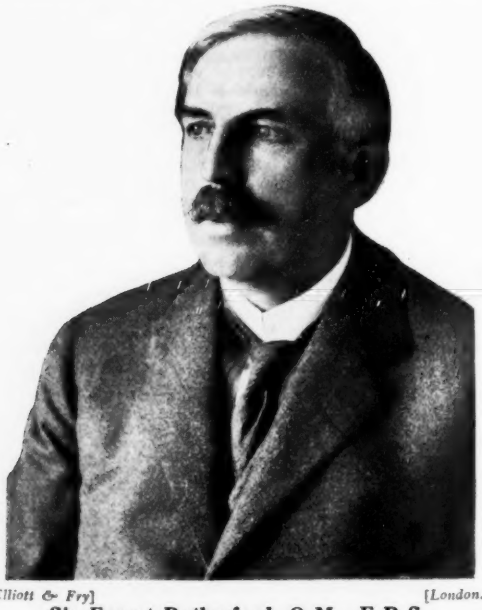
Finsbury Old Students.

The Finsbury Technical College Old Students' Association's dinner will take place on Saturday, February 21st, at the Trocadero Restaurant. Any old student not on the register should apply for particulars to Mr. F. R. C. Rouse, either at 15, Clifton Gardens, Golders Green, N.W.11, or 45, Horseferry Road, Westminster, London, S.W.1.

Our Personal Column.

Electrical men are invited to enable us to keep readers of the "Electrical Review" posted concerning their movements.

New Year Honours.—The names of a number of gentlemen, and a lady, well known to our readers, appeared in the Honours List published on January 1st. The most prominent was that of **Sir Ernest Rutherford,** O.M., whose portrait accompanies these notes, upon whom a barony is conferred. Sir Ernest



Elliott & Fry] [*London.*

Sir Ernest Rutherford, O.M., F.R.S.

Who receives a Barony.

is Chairman of the Advisory Council of the Committee of the Privy Council for Scientific Research, past-president of the Royal Society and of the British Association. We understand that Sir Ernest will take the title of Lord Rutherford. **Dr. F. E. Smith,** C.B., C.B.E., Secretary to the above-mentioned Committee of the Privy Council, and Secretary of the Royal Society is made a K.C.B. (Civil Division).

Mr. W. H. U. Napier, Controller of the London Telephone Service is also awarded the C.B.E.

Sir Richard Gregory, D.Sc., LL.D., editor of *Nature*, receives a baronetcy.

Mr. Maurice G. Simpson, C.S.I., M.I.E.E., Director-in-Chief, Indo-European Telegraph Department, receives a knighthood.

Mr. Herbert C. Morrison, M.P., Minister of Transport, has been appointed a member of the Privy Council.

Mr. O. S. Philpotts, O.B.E., Commercial Secretary at the British Legation, Vienna, is given the C.M.G.

Miss Caroline Haslett, Director of the Electrical Association for Women, and Secretary of the Women's Engineering Society, is made a Commander of the Order of the British

Vandyk] [*London.*

Miss Caroline Haslett, C.B.E.

Empire. We have pleasure in reproducing Miss Haslett's portrait herewith.

Mr. E. J. Jennings, secretary and commercial manager of the Birmingham Electric Supply Department, who has been ill for the past four or five months, is now making good progress towards recovery, we are glad to report.

Mr. Ernest E. Sharp (Venner Time Switches, Ltd.) was to sail for America in the *Aquitania* yesterday (Thursday).

Mr. W. T. Leech has retired from the position of director of telegraphs and telephones, General Post Office, after 45 years' service. He is succeeded by **Mr. L. Simon,** assistant secretary of the inland telegraph branch.

Sir Basil Blackett, chairman of Imperial & International Communications, Ltd., is proceeding to Canada to confer with Dominion interests on behalf of the company.

As we have already reported, **Sir Hugo Hirst, Bt.,** is presenting a portrait of the late Dr. Alexander Graham Bell to the Institution of Electrical Engineers. It will be seen from the accompanying reproduction that the painting, which has been done by Mr. W. W. Russell, R.A., is a worthy addition to the collection of portraits of pioneers and leaders of the electrical profession and industry which adorns the walls of

Dr. Alexander Graham Bell.
Reproduction of a portrait by Mr. W. W. Russell, R.A., presented to the I.E.E. by Sir Hugo Hirst, Bt.

the Institution's lecture theatre. The actual presentation was to be made at yesterday's ordinary meeting.

Sir Hugo Hirst has consented to act as president of the forty-fourth anniversary festival dinner of the London Commercial Travellers' Benevolent Society, which is to be held in October next.

Mr. F. W. Taylor, who, as we reported in our issue of December 19th, has retired from the position of district manager of telephones at Brighton, after 44 years' service, has been presented with a grandfather clock and a silver condiment set by the staff.

Mr. Richard Breerton, sales manager of the Ebonite Department of Redfern's Rubber Works, Ltd., who was elected to the Hyde Town Council two years ago, has been appointed chairman of the Housing and Town Planning Committee for the ensuing year.

Obituary.

Mr. H. J. Dowsing.—We regret to record that Mr. Herbert John Dowsing, M.I.E.E., died on Monday, January 5th, at Sydney House, Farnham Common. According to *The Times* "Deaths" column he passed away suddenly of heart seizure. Mr. Dowsing was a pioneer in luminous electric radiators, electric light and heat treatment, and allied applications of electrical illumination for health purposes. He was managing director of the Dowsing Radiant Heat Co., Ltd., of Baker Street, W., which was formed in 1898, and has branches and works in other parts of London as well. He was also interested in the Dowsing electric light and heat cure institutes in several provincial resorts. Mr. Dowsing became an Associate of the Institution in 1889 and a full member in 1891. The funeral was to take place yesterday (Thursday) at Golders Green Crematorium.

Mr. C. E. Acock.—The death is reported of Mr. C. E. Acock, who had since 1920 been on the staff of the West Ham Electricity Department. When the generating station was flooded in January, 1928, he was on night duty, and through his efforts and those of another employé the supply was not entirely cut off. For his services he was presented with an illuminated address.

Mr. E. Martyn.—The death has occurred of Mr. Edward Martyn, a pioneer of the Australian electrical engineering industry. Born in Cornwall 76 years ago, he went to Australia as a young man. He was a partner in the engineering firm of Price, Martyn & Co., of Sydney, N.S.W.

Prof. E. Goldstein.—*The Times* reports the death, on December 29th, at the age of 80, of Professor Eugen Goldstein. Prof. Goldstein was a leading German physicist, and was at one time a student under Helmholtz who brought Goldstein's work in the study of cathode rays to the knowledge of the Academy of Science. He held the gold medal of the Royal Society.

Mr. J. C. Sykes.—We regret to learn of the death, at the age of 60, of Mr. Joseph C. Sykes, managing director of the W. R. Sykes Interlocking Signal Co., Ltd., and honorary general secretary of the Institution of Locomotive Engineers.

Financial Section.

New Companies, Returns of Share Capital, Debenture Charges, Reports of Electrical Companies, Dividend Changes, Transactions in Stocks and Shares.

New Companies Registered.

Harry Astbury, Ltd.—Private company. Registered December 31st. Capital, £1,000 in £1 shares. Objects: To acquire the business of mechanical and electrical engineers, and agents, representatives and merchants, carried on at 63, Hockley Hill, Birmingham, as "Harry Astbury," and the assets and liabilities in connection therewith as existing on January 1st, 1931. The directors are: H. Astbury, 24, Wye Cliff Road, Handsworth, Birmingham, engineer; A. E. Smith, 97, Walford Street, Tividale, Staffs, engineer. Registered office: Abbey House, 63, Hockley Hill, Birmingham.

Provincial Wholesale Co., Ltd.—Private company. Registered December 30th. Capital, £10,000 in £1 shares. Objects: To carry on the business of wholesale dealers in and warehousemen of cables, wires, lines, accumulators, dynamos, and lamps; electrical, mechanical, civil or constructional engineers, &c. The directors are: J. G. Barnett, "The Nook," 43, Main Street, Stapenhill, Burton-on-Trent; R. C. Soans, Queensberry Road, Kettering; A. Gould, James Street, Stoke-on-Trent. Registered office: 118a, High Street, Burton-on-Trent.

Coralys, Ltd.—Private company. Registered December 30th. Capital, £3,000 in £1 shares. Objects: To carry on the business of electrical engineers and contractors, manufacturers of and dealers in electrical, gas, and oil fittings, lamps, lampshades, and modern decorations, &c. The subscribers (each with one share) are: D. Gayler, 25, Ramuz Drive, Westcliff-on-Sea, secretary; A. Timperi, 61, Swain's Lane, Highgate, N.6. Secretary: A. E. J. Mansfield. Registered office: Walmar House, 288, Regent Street, W.1.

Bulle Co., Ltd.—Private company. Registered December 31st. Capital, £6,000 in 590 5 per cent. preference shares of £10 each and 1,000 "A" ordinary and 1,000 "B" ordinary shares of 1s. each. Objects:—To adopt an agreement with the British Horo-Electric Ltd., and to carry on the business of manufacturers of and dealers in electrical, mechanical, wireless and other watches, chronometers, clocks, timepieces, and horological and chronological instruments, appliances, and accessories, &c. The subscribers are: H. J. Fellowes, 56, Rathcoole Gardens, Hornsey, N.8; W. C. Paske, 31, Amerland Road, Wandsworth, S.W.18, clerks. Registered office: 83, Hatton Garden, E.C.1.

Hillfields Electrical Co., Ltd.—Private company. Registered January 1st. Capital, £1,000 in £1 shares. Objects: To carry on the business of electrical engineers and contractors, manufacturers of and dealers in electrical and wireless appliances &c. The subscribers (each with one share) are: F. W Harris, "The Nook," Stoke Green, Coventry, electrical con-

tractor: C. J. Walden, "Old Crown," Windmill Road, Longford, Coventry, clerk. F. W. Harris is permanent managing director. Solicitors: Pridmore & Nelson, Coventry.

Reliance Electrical Co., Ltd.—Private company. Registered January 1st. Capital, £500 in £1 shares. Objects: To carry on the business of manufacturers and repairers of and dealers in electrical, gas, and oil lamps, quartz lamps, reflectors, bells, fires, stoves, &c. The directors are: P. E. Shephard, "Bignores," Dartford, Kent; Miss Elsa L. Meyer, "Brantwood," Erith Road, Bexley Heath, Kent; J. C. Walker, "Wychall," Birchwood Road, Wilmington, Kent. Registered office: 57, Lowfield Street, Dartford.

Electric Time Systems, Ltd.—Private company. Registered January 1st. Capital, £1,000 in £1 shares. Objects: To carry on the business of manufacturers of clocks, watches, chronometers and time pieces of all kinds, mechanical and electrical contrivances, &c. The directors are: G. H. H. Maud and J. N. Maud, "Nellbank," Middleton, Ilkley. Secretary: E. Jones. Registered office: Haworth's Buildings, 5, Cross Street, Manchester.

Fenemore, Howlett & Co., Ltd.—Private company. Registered January 1st. Capital, £10,000 in £1 shares. Objects: To acquire the businesses (1) of an electrical engineer now carried on by A. E. Farrow, at 107, High Street, Eton, as "Fenemore and Company," and (2) of an electrical, general, and wireless engineer, now carried on by C. R. B. Howlett, at 14 and 16, Victoria Street, Windsor, as "Howlett & Sons." The directors are: A. E. Farrow, "Braeside," Ledger's Road, Slough: C. R. B. Howlett, "Sunstead," York Avenue, Windsor; W. O. Farrow, address not stated. Solicitors: Lovegrove & Durant, 4, Park Street, Windsor.

Regentone, Ltd.—Private company. Registered January 1st. Capital, £200 in 100 "A" shares of £1 and 400 "B" ordinary shares of 5s. each. Objects: To carry on the business of manufacturers of and dealers in wireless and electrical goods, gramophones, musical instruments, television apparatus, &c. The subscribers are: W. E. Longquest and S. Jarrett, 17, Shaftesbury Avenue, W.1, solicitors. Solicitors: Stanley Jarrett & Co., 17, Shaftesbury Avenue, W.1.

Lee J. Allen Co., Ltd.—Private company. Registered December 30th. Capital, £1,000 in £1 shares. Objects: To acquire the benefit of a certain invention relating to improvements in electric water heaters, in respect of which invention provisional protection has been obtained under No. 32379. The directors are: A. J. Levey (chairman), 15, Great Stanhope Street, W.1; H. Baron, 56, Chatsworth Road, Brondesbury, N.W.2. Registered office: 87, Regent Street, W.1.

Lissen, Ltd.—Registered as a public company January 1st. Capital, £1,000,000 in £1 shares (500,000 8 per cent. cumulative preference and 500,000 ordinary). Objects: To acquire the business of manufacturers of and dealers in wireless and other apparatus and accessories carried on by Lissen, Ltd. (incorporated in 1923) at Richmond, Isleworth, Edmonton, and elsewhere; also to carry on the business of manufacturers of and dealers in gramophones, sparking plugs, accumulators, &c. The first directors are: Magnus Goodfellow, Lyonsdown, New Barnet, Herts., chairman of Ever-Ready Co. (Great Britain), Ltd.; T. N. Cole, Westleigh Avenue, Putney Hill, S.W.; W. T. Walker, 41, The Pryors, Hampstead, N.W.3; R. P. Richardson, 100, Sandy Lane, Teddington, manager. Registered office: Lissenium Works, Worple Road, Isleworth, Middlesex.

Apple, Ltd.—Private company. Registered December 29th. Capital, £150 in £1 shares. Objects: To carry on the business of wholesale and retail wireless merchants, electrical, wireless and mechanical engineers and manufacturers, &c. The permanent directors are: B. Apple and Mrs. H. Apple, 87, Tottenham Court Road, W.1. Registered Office: 87, Tottenham Court Road, W.1.

Dempster Moon & Co. (Machinery), Ltd.—Private company. Registered December 26th in Edinburgh. Capital, £5,000 in 3,000 ordinary and 2,000 preferred shares of £1 each. Objects: To carry on the business of electrical, mechanical, constructional and general engineers, agents, merchants, &c. The directors are: J. R. Auld, Garfield House, Stepps, Glasgow, manufacturers' agent; J. M. Rollo, Ardgrochan, Lennoxtown, Glasgow, engineer. Registered office: 201, Pollokshaws Road, Glasgow, S.1.

Fireless Rearers, Ltd.—Private company. Registered January 2nd. Capital, £200 in £1 shares. Objects: To carry on the business of manufacturers of and dealers in fireless rearers and all kinds of poultry houses and appliances, batteries, acids and containers, and electrical plant, fittings, apparatus, lamps, &c. The permanent directors are: F. S. Hubbard, 36, North Street, Dunmow, poultry appliance manufacturer (managing director); H. O. Coates, 15, North Street, Dunmow. Secretary: W. Edwards.

Thermo Fire Alarm, Ltd.—Private company. Registered January 2nd. Capital, £1,000 in £1 shares. Objects: To carry on the business of manufacturers of and dealers in fire extinguishers, fire alarms and fire protection instruments, electrical and other engineers, &c. The directors are: H. Hirst and Mrs. Alice A. Hirst, 138, Chorley New Road, Bolton; R. G. Hirst, Kendlemere, Windermere Road, Blackpool; J. H. Jackson, 87, Crescent Road, Bolton. Registered office: 27, Mawdsley Street, Bolton.

F. E. Harmer & Co., Ltd.—Private company. Registered January 5th. Capital, £450 in £1 shares (300 10 per cent. participating preference and 150 10 per cent. ordinary). Objects: To acquire from F. E. Harmer a special invention for fitting to wireless to prevent damage by lightning, and to carry on the business of manufacturing and selling the patent "Spa" safety aerial fuse for fitting to wireless receiving sets, &c. The directors are:—F. E. Harmer, Raydale, Chatburn, Lancs.; F. H. Bleasdale, 31, Hastings Road, Bolton; G. Aspden, 10, St. James' Road, Blackburn. Secretary: G. Aspden. Registered office: Knowsley House, Knowsley Street, Bolton.

British Relay Wireless, Ltd.—Private company. Registered January 2nd. Capital, £1,000 in £1 shares. Objects: To acquire and grant concessions for establishing, maintaining, and working wireless receiving stations in the U.K. of Great Britain and Northern Ireland, the Irish Free State, British Dominions, Colonies and Dependencies of Great Britain, and also in foreign countries; to obtain licences in connection therewith, &c. The directors are:—K. G. S. Hatfield, 22, Rosslyn Hill, Hampstead, N.W.3; N. F. C. Forsyth, 54, Circus Road Mansions, N.W.8, clerk; A. M. de L. de Meux, 262, Vondelstraat, The Hague, Holland, architect; K. du Pre, 42, Fultonstraat, The Hague, Holland, economic adviser. Secretary: N. F. C. Forsyth. Registered office: Temple Chambers, Temple Avenue, E.C.4.

Official Returns of Electrical Companies.

Burovox, Ltd.—Debenture dated December 17th, 1930, to secure £1,540, charged on the company's property, present and future, including uncalled capital. Holders: E. S. Haslam, Breadsall Priory, near Derby, and others.

Pontypool Electric Light & Power Co., Ltd.—Issue on December 12th, 1930, of £1,000 debentures, part of a series already registered.

Edward Wilcox & Co., Ltd.—Satisfaction to the extent of £500 on December 22nd, 1930, of debentures authorised December 18th, 1924, and registered April 4th, 1925.

Surbiton Contract Co., Ltd.—Satisfaction in full on August 28th, 1930, of charge dated July 28th, 1930, and registered July 30th, 1930. (According to the register of mortgages, the only charge registered on July 30th, 1930, was a memorandum of deposit which originally secured all moneys due or to become due from the company to Barclay's Bank, Ltd.)

Edward Dewhurst, Ltd.—Capital, £20,000 in £1 shares. Return dated September 10th, 1930. 15,672 shares taken up. £1,502 paid. £14,170 considered as paid. Mortgages and charges, nil.

T. C. Gilbert & Co., Ltd.—Capital, £5,000 in £1 shares. Return dated September 12th, 1930. 3,200 shares taken up. £2,300 paid. £900 considered as paid. Mortgages and charges, £443 19s. 8d.

Belshaw & Co., Ltd.—Capital, £3,000 in 2,000 preference and 1,000 ordinary shares of £1 each. Return dated November 4th, 1930. All shares issued and called up. Mortgages and charges, £3,500 debentures.

Drake & Gorham, Ltd.—Capital, £125,000 in £1 shares. Return dated November 14th, 1930. All shares taken up. £85,000 paid. £40,000 considered as paid. Mortgages and charges, £24,350.

W. R. Sykes Interlocking Signal Co., Ltd.—Capital, £37,550 in 46,173 "A" shares of 10s., and 41,327 "A" shares of 7s. each (reduced from £50,000 in May, 1930). Return dated October 29th, 1930. 41,327 7s. "A" shares taken up and fully paid up. Mortgages and charges, £17,526.

Warren Bros. (Middlesbrough), Ltd.—Capital, £20,000 in 16,000 ordinary and 4,000 deferred shares of £1 each. Return dated August 26th, 1930. 8,030 ordinary and 4,000 deferred shares taken up. £7,904 paid on 7,904 ordinary shares. £4,126 considered as paid on 126 ordinary and 4,000 deferred shares. Mortgages and charges, £1,700.

T. H. Satchwell, Ltd.—Capital, £3,000 in £1 shares. Return dated October 9th, 1930. 2,502 shares taken up. £1,252 paid. £1,250 considered as paid. Mortgages and charges, nil.

Holophane, Ltd.—Capital, £100,000 in £1 shares. Return dated October 10th, 1930. All shares taken up. £7 paid. £99,993 considered as paid. Mortgages and charges, nil.

Three Spires Electric, Ltd.—Capital, £500 in £1 shares. Return dated September 30th, 1930. Eight shares taken up. £8 paid. Mortgages and charges, £700.

Nutter, Son & Edge, Ltd.—Capital, £5,000 in £1 shares. Return dated October 9th, 1930. 4,787 shares taken up. £3,987 paid £800 considered as paid. Mortgages and charges, nil.

Twentyman & Willmott, Ltd.—Capital, £800 in 348 10 per cent. first preference, 52 6½ per cent. preference and 400 ordinary shares of £1 each. Return dated September 29th, 1930. 400 ordinary, 52 6½ per cent. preference and 165 10 per cent. first preference shares taken up. £417 paid on the 10 per cent. and 6½ per cent. preference and 200 ordinary shares. £200 considered as paid on 200 ordinary shares. Mortgages and charges, £189.

Devereux, Moodie & Co., Ltd.—Capital, £5,000 in 2,500 preference and 2,500 ordinary shares of £1. Return dated August 29th, 1930. 1,900 preference and 1,001 ordinary shares taken up. £2,901 paid. Mortgages and charges, nil.

Wholesale Supply Co. (Hull), Ltd.—Capital, £4,000 in 2,000 preference and 2,000 ordinary shares of £1 each. Return dated November 19th, 1930. 1,750 preference and 2,000 ordinary shares taken up. £3,750 paid. Mortgages and charges, nil.

Leslie Fink, Ltd.—Particulars filed of debentures for sums not exceeding £1,000 at any one time, authorised December 8th, 1930, charged on the company's property, present and future, including uncalled capital, the amount of the present issue being £1,000.

George H. Scholes & Co., Ltd.—Capital, £8,000 in 5,000 preference and 3,000 ordinary shares of £1 each. Return dated September 12th, 1930. 4,337 preference and 3,000 ordinary shares taken up. £4,951 paid on 3,951 preference and 1,000 ordinary shares. £2,386 considered as paid on 386 preference and 2,000 ordinary shares. Mortgages and charges, nil.

"M.P.A." Wireless (1930), Ltd.—Issue on December 5th, 1930, of £150 debentures, part of a series already registered.

Aeonic Radio, Ltd.—Charge created by liquidator on land with messuage, factory, and buildings thereon at Salfords, Horley, Surrey, dated December 8th, 1930, to secure all moneys due or to become due from the company to Lloyds Bank, Ltd., not exceeding £16,000.

Fairylites, Ltd.—Satisfaction to the extent of £200 on October 17th, 1930, of mortgage dated October 2nd, 1929, and registered October 3rd, 1929. (According to the register of mortgages, the mortgage registered on October 3rd, 1929, originally secured £5,600.)

City Notes.

John Shaw & Sons (Wolverhampton), Ltd.

Presiding at the annual meeting on December 29th, Mr. G. Terrell (chairman) said that the company's home trade in tools showed an increase in the year under review, but a decline so far in the current year. They had not lost any of their connection, but their customers owing to the general depression were buying less than they ordinarily bought. Their electrical department showed a small loss, but sales were steadily increasing in spite of the general depression, and they ought to do very much better for the current year. They were doing a trade on hire-purchase terms in domestic electrical appliances. The report and accounts were adopted.

Companies Struck Off the Register.

The names of the following companies have been struck off the Register, and the companies are thereby dissolved:—

Accumulator Charging Co., Ltd.
Aleon Radio Products, Ltd.
Defiance Electrical Co., Ltd.
Racon Electrical Co., Ltd.
"Thermionics," Ltd.
Tidal Power Syndicate, Ltd.
Tudoradio Co., Ltd.

Puebla Tramway, Light & Power Co., Ltd.

There was a considerable increase in the net revenue during 1929, the figures being £174,372, as against £128,242. After making provision for all expenses, interest, &c., there is a balance of £46,504, which is deducted from the debit balance of £135,909 brought in, leaving a deficit of £89,405 to be carried forward. The chief cause of the expansion of business was an increase in the bulk supply to the Vera Cruz Electric Light, Power & Traction Co.

Westinghouse Brake & Saxby Signal Co., Ltd.

The accounts for the year ended September 30th last show a profit of £102,557, as compared with £102,292 in the previous year. To this is added £13,033 brought in making £115,590 available. It is proposed to pay a dividend of 8 per cent. (same) and to place £30,000 to depreciation and contingencies reserves, leaving £14,709 to be carried forward. Meeting: January 16th.

Companies' Proposals to Dover Corporation.

According to the *Dover Express*, the report of Dover Town Council in committee recently presented to the Council, indicates that the two big electrical concerns are about to make offers for the purchase of the Dover electricity undertaking. One company, the South-East Kent Electric Power Co., is a subsidiary of the County of London Electric Supply Co., Ltd. The other company is the Electric Development and Securities Trust, Ltd. Offers are to be submitted by January 20th.

South Wales Power Co., Ltd.

At an extraordinary meeting held on January 2nd, the shareholders agreed to the sale of the whole of the assets of the company to the Shropshire, Worcestershire and Staffordshire Electric Power Co. for £1,265,000. Mr. W. North Lewis (chairman) said that it was anticipated that the return to the ordinary stockholders would be in the region of £70 per cent.

Ruths Steam Storage, Ltd.

The annual meeting was held on December 29th, and was adjourned. Mr. W. S. Eyre (chairman) who presided, said that they had received an offer from the "B" shareholders for the acquisition of the "A" shares. The conditions of that offer would be submitted to the shareholders as soon as certain formalities had been complied with.

Redfern's Rubber Works, Ltd.

We have just received a copy of a circular sent to the company's loan-holders announcing that in view of the company's financial strength it had been decided to repay all loans, with accrued interest, on December 31st.

Murex Welding Processes, Ltd.

This company has been formed by the amalgamation of Alloy Welding Processes, Ltd., and the Premier Electric Welding Co., Ltd. The offices and works will remain at Forest Road, Walthamstow, E.

Anglo-Argentine Tramways Co., Ltd.

The traffic receipts for the year ended December 31st last were £1,249,635. This was a decrease of £270,937, as compared with the previous year.

Stocks and Shares.

TUESDAY EVENING.

THE Stock Exchange markets started the year with a reproduction of the main features outstanding last month. That is to say, the gilt-edged securities continue in favour, while the more speculative propositions are moving irregularly. The Bank Rates of Paris and New York have both been lowered to 2 per cent., which makes the Bank of England Rate of 3 per cent. look unwarrantably high. Monetary conditions suggest, however, that special reasons must have prevailed to bring about reductions in the Bank Rates abroad, which reasons do not apply in London. There is, nevertheless, strong expectation of a reduction being made in our own Bank Rate. Rumours are renewed concerning the likelihood of Mr. Snowden tackling at an early date the conversion of the 2,000 million pounds 5 per cent. War Loan.

Two Electricity Investments.

London and Home Counties Joint Electricity Authority 4½ per cent. stock, dated 1955-1975, has now come to market, and after being dealt in on the basis of par, the issue price, that is 95½ per cent., the quotation strengthened to 10s. premium. The stock is not a trustee security, but the margin behind the interest service is so substantial as to render the stock a first-class investment. Recognition of this has resulted in blocks of the stocks being taken by companies and financial houses. Smaller amounts have been purchased by the ordinary investor anxious to employ money at 4¾ per cent. In view of the fact that there are very few stags about, it is considered probable that the price will outstrip that of the earlier-issued Central Electricity Board 4½ per cents., which are closely akin to the London and Home Counties stock, and stand at about the same price as the latter. The Central Board issue was made at a time when people were falling over one another, as the saying is, to obtain allotments for the purpose of selling these at a profit, the result being that a good deal of stock went into temporary hands. As soon as this stag stock is taken by the genuine investor, the price will have a chance of moving upwards.

Notting Hill Debenture.

Most people agree that gilt-edged stocks are standing, as a whole, at inflated levels, and that there is fairly sure to be a reaction in prices whenever an improvement in trade brings about a demand for cash that is required to be utilised in trade and commerce. At present, however, the industrial out-

look, in spite of the hopefulness reflected in New Year's speeches, is not sufficiently settled to encourage any particular demand for capital. The consequence follows that prices of British Government securities, which are leading the markets, have gone ahead notably since the beginning of the year. To give an idea of the avidity with which stock is taken, the fact may be mentioned that early this week a few thousand pounds of Notting Hill Electric 5 per cent. debenture came on offer at 102½, free of stamp and fee. The stock was taken almost immediately attention had been drawn to it.

Cables and Wireless.

A fall of 1½ points has taken Cables & Wireless preference stock to 68½. This means that the stock pays 8 per cent. on the money, assuming, of course, that the dividend is duly met. The market thinks that no doubt need be felt on this point, so far as the forthcoming March dividend is concerned. It is the future outlook which is holding back the price of the stock. The "A" ordinary stock shows no change, but the "B" ordinary at 12 is 10s. to the good. Globe preference fell ½ to 10¼. Anglo-American deferred at 26 has lost 5s. of its recent improvement. American Telephone and Telegraph spurted to 190, a gain of 7½ points. International Telephone & Telegraph at 22½ is 2 dollars up. The last company, through its Rumanian subsidiary, has purchased the national telephone system of Rumania for approximately £900,000. It is stated that the undertaking comprises more than 5,000 telephone stations and long-distance lines between all Rumanian cities.

Electricity Supply.

Chelsea ordinary shares at 28s. are 6d. better, and County of London ordinary rose 1s. 3d. to 48s. 9d. Save for these alterations, the list of London shares is unaltered. Dealers report a readiness to absorb shares which come in, but state that, as the supply is extremely limited, it has become increasingly difficult for the buyers to obtain what they require. Amongst the foreign issues, River Plate Electricity ordinary has shed 5 points, going back to 190. Prussian Electric 6 per cent. 25-year bonds weakened to 73½. The Indian and Burmese electrical shares keep steady. Egham and Staines are 4s. higher at 37s. Richmond (Surrey) are 1s. up at 43s. 6d. British Light and Power shares remain at 12s. Outside this class, Atlas ordinary are quoted at 20s. 9d., and the preference at 25s. Tokyo 6 per cent. bonds strengthened to 90. Victoria Falls ordinary have declined to 38s.

Home Railway Stocks.

Metropolitan Railway ordinary at 68 has gone back 10s., otherwise the list of prices is unchanged from that of a week ago. The 4½ per cent. debenture stocks recently issued by the Central London and the London Electric Railways, at 99½, have risen to 4¼ premium, this being ex the small amount of interest due last Friday. The Central London debenture is practically all placed, but there is £5,000 of the London Electric on offer at 104¾, yielding £4 15s. 6d. per cent. on the money. This stock can be bought at the moment free of stamp and fee. It is available for trustees, and so, also, is £10,000 Metropolitan Railway 3½ per cent. debenture, offered at 75, and £5,000 of the same railway's 3½ per cent. convertible preference at 75¼, these paying 4¾ per cent. and £4 14s. per cent., respectively, on the money. The London tramway descriptions are hardly mentioned.

Dollar Stocks.

Brazilian Tractions are a better market at 22½, and there has been rather more support rendered to American and Canadian utilities during the first week of the year. Power Corporation of Canada shares at 53 are a little better. Shawinigan Water remain at 52. The Mexican group is uninteresting. Amongst the sterling stocks, Anglo-Argentine Tramways 5 per cent. debenture, after being 1½ up to 56, reacted to its previous price of 54½. The Puebla Tramway, Light and Power Company publishes an excellent annual report. Net income in Mexico is returned at £174,372, showing an increase of £46,000. The reason for the demand for the shares from New York is now apparent. No dealings are recorded in London for a month; the last price was about 30s.

Manufacturing and Equipment.

British Aluminium ordinary shares have receded to 30s., but, on the other hand, the newly-issued debentures, which were down to 3½ discount, have strengthened to 2 discount. Callender's at 3 3/16 are 1/16 lower; Enfield Cables ordinary shares at 4¾ are similarly better. It may be of interest to mention that there is on offer £2,000 5½ per cent. guaranteed first mortgage debentures of Edison Swan Cables, Ltd. Interest is payable on 1st January and July. The price is ex the broken amount of 4s. 2d. per cent. which was due on New Year's Day. Principal, interest, and sinking fund are unconditionally guaranteed by the Edison Swan Electric Co., Ltd. Siemens are a firm market at 21s. 3d., on the announcement that the Central Electricity Board has placed contracts with the company for primary transmission lines. Amongst iron, steel, and allied shares, Babcocks recovered to 50s., while Vickers are steady at 7s. There is a little demand for Armstrong Whitworth Trust shares. Rubber shares are dormant; nothing is doing in the market, one way or the other, to attract public attention.

Share List of Electrical Companies.

	Nom.	Approx. Dividend. 1928.	1929.	Price Jan. 6 1931.	Rise or fall.	Yield p.c.
HOME ELECTRICITY COMPANIES.						
Bournemouth and Poole	£ 1	15	15	3½	—	4 17 10
Brompton Ordinary	1	8½	8½	27/6	—	5 1 10
Charing Cross Ordinary	1	8)	8)	29/-	—	4 16 7
do. do. 4½% Pref.	1	4½	4½	18/-	—	5 0 0
Chelsea	1	8⅝	8⅝	28/-	+6d.	5 0 0
City of London	1	10	10	36/3	—	5 10 3
do. do. 6% Pref.	1	6	6	24/6	—	4 18 0
Clyde Valley	1	8	8	34/6	—	4 12 9
County of London	1	7	10	48/9	+1/16	4 2 0
do. do. 6% Pref.	1	6	6	24/-	—	4 18 0
Edmundsons' 7% Pref.	1	7	7	25/6	—	5 9 10
Elec. Supply Corporation	1	11	11	48/9	—	4 10 0
Kensington Ordinary	1	8	8	27/6	—	5 1 10
Lancs. Light and Power	1	7½	7	25/-	—	5 12 0
London Electric	1	8½	9	32/6	—	5 10 9
Metropolitan	1	9	10	42/-	—	4 15 3
do. 4½% Pref.	1	4½	4½	18/-	—	5 0 0
Midland Counties	1	6½	7	28/6	—	4 18 3
Mid. Elec. Power	1	15	8	31/3	—	5 2 5
Newcastle-on-Tyne Ordinary	1	6	6	24/6	—	4 18 0
do. 7% Pref.	1	7	7	27/6	—	5 1 10
Notting Hill 6% Pref.	10	6	6	11½	—	5 6 8
North Met. Elec. 6% Pref.	1	6	6	24/-	—	5 0 0
St. James' and Pall Mall	1	8	8	28/-	—	5 0 0
Scottish Power	1	8	8	29/6	—	5 8 6
South London	1	8½	8½	27/-	—	5 3 8
Urban Ordinary	1	7	7	29/6	—	4 15 0
Westminster Ordinary	1	8½	8½	29/-	—	4 16 7
Whitehall Elec. Invst. 7½% Pref.	1	7½	7½	25/6	—	5 17 8
Yorkshire Elec.	1	8	8	34/6	—	4 12 9
HOME RAILS.						
Central London Ord. Assented	Stock	4	4	79	—	5 0 9
Metropolitan	,,	3½	4	68	—½	5 17 10
do. District	,,	4	5	77	—	6 9 10
Underground Electric	£1	7	8	24/6	—	6 10 8
do. do. Income	Bonds	6	6	104	—	5 15 5
TELEGRAPHS AND TELEPHONES.						
Anglo-Am. Tel. Pref.	Stock	6	6	103½	—	5 16 7
do. Def.	,,	1½	1½	26	—¼	5 15 5
Automatic Telephone	1	10	12½	38/9	+1/16	6 8 10
Cables & Wireless 5½% Pref.	Stock	—	5½	68½	—1½	8 0 8
do. A 7½% Ord.	,,	—	—	22½	—	... ...
do. B Ord.	,,	—	—	12	+½	... ...
Globe Tel. and T. Ord.	10	10	10	13xd	—	7 13 10
do. do. Pref.	10	6	6	10⅝	—⅛	5 13 0
Great Northern Tel.	10	20	20	30	—	6 13 4
Marconi-Marine	1	12½	15	38/9	—	7 15 0
Oriental Telephone Ord.	1	12	12	2⅜	—	*5 1 1
HOME AND FOREIGN TRAMS, &c						
Anglo-Arg. Trams First Pref.	5	5½	5½	1⅜	—	... ...
do. do. 2nd Pref.	5	6	6	17/6	—	... ...
do. do. 5% Deb.	Stock	5	5	54½	—	9 3 6
British Electric Traction Def. Ord.	,,	5	5	1325	—	... ...
do. do. Pref. Ord.	,,	8	8	132½	+1	6 0 9
Brazil Traction	100	7	8	22½	+1½	... ...
Brit. Columbia Elec. Rly. Pce.	Stock	5	5	96½	—	5 3 7
London & Sub. Trac. 5% Pref.	1	Nil	Nil	11/6	—	... ...
London United Tram Deb.	Stock	4	4	53½	—	7 9 10
Mexico Trams, 5% Bonds	—	5	5	62	—	8 1 4
Mexican Light Common	100	Nil	Nil	42½	—	... ...
do. 7% Pref.	100	7	7	64½	—	10 17 0
do. 1st Bonds	—	5	5	80	—	6 5 0
Victoria Falls Ord.	1	15	15	58/-	—9d.	5 8 5
Yorkshire (West Riding)		Nil	Nil	5/6	—	... ...
MANUFACTURING COMPANIES.						
Assoc. Elec. Ord.	1	6	6	20/6	—	5 17 1
Babcock & Wilcox	1	18	15	50/-	+6d.	*6 0 0
British Aluminium Ord.	1	10	10	30/-	—6d.	6 13 4
British Insulated Ord.	1	15	15	3⅜	—¼	4 9 0
Brush Ord.	Stock	10	10	105	—	9 10 6
Callenders	1	15	15	3 3/16	—1/16	4 14 1
do. 6½% Pref.	1	6½	6½	25/-	—	5 4 0
Crompton Parkinson Ord.	5/-	—	30	21/3	—	7 1 2
do. 8% Pref.	1	8	8	26/3	—	6 2 0
Edison-Swan 1st Pref.	1	7½	7½	23/9	—	6 6 4
do. 5% Deb.	Stock	5	5	92½xd	—	5 8 1
Electric Construction	1	5⅜	5	12/-	—	8 6 8
Enfield Cable Ord.	1	20	25	4⅜	+1/16	5 14 2
English Electric	1	Nil	Nil	10/-	—	... ...
do. do. Pref.	1	3	Nil	10/-	—	... ...
Ferranti Pref.	1	7	7	21/6	—	6 10 4
G.E.C. Pref.	1	6½	6½	25/6	—	5 2 0
do. Ord.	1	10	14	43/9	—	6 7 9
Henley	1	25	30	5¾	—	5 2 0
do. 4½% Pref.	5	4½	4½	4⅜	+⅛	5 2 10
India-Rubber	1	Nil	Nil	6/3	—	... ...
Johnson & Phillips	1	10	10	36/9	—	5 8 10
Siemens Ord.	1	7⅜	7⅜	1 1/16	—	7 1 2
Telegraph Construction	12	10	10	16½	—	7 5 6

*Dividends paid free of Income Tax.

Trade Prospects in China.

Changing Conditions in a Difficult Market.

THE Department of Overseas Trade has published (through the Stationery Office, 2s. 6d. net) a report upon economic conditions in China to August 30th last by Mr. E. G. Jamieson, C.B.E., Acting Commercial Counsellor at Shanghai, with an annex on the trade of South Manchuria by Mr. W. B. Cunningham, British Consul at Dairen.

In common with most of the recent D.O.T. reports this one is prefaced by a lengthy and useful commercial summary which contains salient facts relating to the country's area, population, currency, communications, weights and measures, &c., together with particulars of the import and export trade. From this it is seen that with regard to imports Shanghai is credited with four times the trade of the next port, Dairen. The actual figure for 1929 was 624,645,823 Haikuan taels (£82,830,578), about half of the total Chinese import trade, which was 1,265,778,821 (£167,781,620).

A Guide to Trading Methods.

The report proper opens with a number of "hints to travellers in China," comparing the various routes, describing touring arrangements, and giving an indication of expenses. Then follow some hints to merchants and manufacturers. In this section it is recommended that information and advice regarding conditions in China should be obtained from the Department of Overseas Trade. Mr. Jamieson says that the question of agencies and representatives is an increasingly complicated one largely owing to the growing share taken by Chinese firms in the foreign trade of the country. The general depression, new legislation, the growth of local industries, increasing competition and uncertainty with regard to the future have made firms reluctant to branch out into new lines.

A report by "one of the principal local engineering firms" is quoted, which says that there is a tendency for British firms to relinquish responsibility for their goods once they have been shipped, their representatives being left to shoulder all difficulties which may arise subsequently. It is also said that the agents cannot afford to advertise their principals' goods extensively without assistance. Foreign competitors are more generously supported by literature and funds for advertising. These agents state that with a revival in trade they are confident of their ability to capture a fair share of the increased business, provided British manufacturers render more assistance. It is of no use relying upon the high quality of goods and waiting for orders to come. Mr. Jamieson expresses his pleasure at being able to record that during the past year certain British interests have sent members of their boards to visit China and study conditions on the spot. In most cases, he says, much benefit has been derived and the practice is one which cannot be too strongly recommended.

Dealings with Chinese Firms.

It is said that the desire on the part of the Chinese merchant to deal directly with the manufacturer or merchant abroad is on the increase, nor is there any reason, in principle, why this desire should be discouraged. In certain ways a Chinese firm may be a more successful agent than a British one for the sale of British goods; their overhead costs are lower, and their connection with the Chinese buyer, especially up-country, probably much closer. The objection, of course, is the difficulty of ascertaining the real financial standing of a Chinese firm and it must be confessed, the difficulty of obtaining redress through Chinese courts during this transition period. The development in commercial advertising, which was referred to in the last report, continues to grow. The local directory gives the names of 22 advertising agencies, both foreign and Chinese, and great advances have been made in the use of neon lights. Again, however, the complaint is made that the British manufacturer will not assist his agent in advertising.

Parallel with the desire to open up direct relations with foreign firms, the Chinese are developing domestic production. The lower prices which are charged for home-produced articles have stimulated this development. So far as electrical goods are concerned there were exported from China during 1929 electric lamps, materials and fittings valued at 388,802 taels. Although this was well above the 1928 figure (262,101 taels) it fell short of the value of the exports of this class in 1925 (473,578 taels).

The Electrical Import Trade.

The report states that although in textile machinery British goods have a firm hold upon the market, it is to be regretted that British firms have lost ground in the market for electrical engineering products. The criticism is made that Continental and American electrical firms are exceedingly well organised, and they have had well-organised offices in China for many years. "British electrical firms seem to have been so occupied with important developments in Great Britain that China has been neglected. Accordingly in this line we are in the novel position of having British goods regarded as inferior to foreign goods, and the British electrical manufacturer is faced with no easy task to make any headway in the China market." It is also stressed that such things as fans, lamps, switches and other accessories are being produced in ever-increasing quantities by factories in China; with increases in tariff rates this tendency to manufacture locally is likely to develop. On the subject of internal-combustion engines a report by a leading British engineering firm is quoted to show why British makers find it difficult to compete. It is admitted that the British engine is a finer product, but German makers have put on the market a much lighter type to do the same work, at a price 20 or 25 per cent. lower. The suggestion is made that British manufacturers should endeavour to produce a more competitive engine to meet this situation.

Imports of the principal classes of machinery in 1929 including power station plant, exceeded those of the previous year by more than 10 million taels. In spite of this, business during the period can only be described as moderately satisfactory owing to changes in conditions of purchase, particularly the attempt of the Ministry of Railways to concentrate purchases for the various railways in a Purchasing Commission.

Besides this effort, the Government, through its newly-created Bureau of Construction, is also trying to control electrical enterprises in China through one Board. The declared policy of the Government is to obtain full control of all privately-owned electric light plants in China, and run them under a central Government organisation. Naturally they have met with very great opposition from the various private enterprises, and through the efforts of these private enterprises a certain opposition has been created in the Government itself against the methods of this Bureau. Nevertheless, it has taken over a number of privately-owned plants which it is running through its own engineers. Although this influence does not reach very far from Shanghai these activities have made private owners nervous and have stopped, for the time being at least, extensions of plants which otherwise would have been called for.

Trading Difficulties.

A number of factors combine to create a much higher cost of doing business for engineering firms in China than was the case a few years ago. The only offset against these adverse conditions is the fact that the engineering business is developing more and more on a technical basis to a point where ordinary import firms who used to dabble in engineering on a small commission basis are finding it difficult to compete against speciality firms who employ experts in the various lines.

A certain number of contracts were, of course, placed during last year, of which British manufacturers probably secured their fair share, but lack of funds and low exchange have prevented the carrying out of schemes involving the purchase of machinery of all types. For some reason or other German and other Continental firms appear to be able to accept contracts on extended terms of credit such as no British firm can look at.

Mr. Jamieson says that one has so constantly heard on all sides that there is "nothing doing," that markets are dull and that business is impossible under existing conditions, that a too pessimistic viewpoint may have been unconsciously acquired. For this reason he refers again to what was described in his 1929 report as the brighter side of the picture, and to emphasise the fact that friendly relations have been restored between the British and Chinese merchants and people as a whole. British goods are popular, our reputation for fair dealing still holds good, but price is the dominating factor. It has been said, and probably not without truth, that whereas there are constant reports of stagnation in the old-established lines of business, the balance of British trade is being made up in other directions. Furthermore, that while it is known that certain firms with large overhead charges have not been in the most prosperous condition in recent years, banks have found that there has been a tendency for business to spread itself over a large number of small concerns able to exist on minute margins of profit.

It cannot be too strongly emphasised that trading conditions have changed and are changing very rapidly. Tariff autonomy was restored to China as from February 1st, 1929, and one year later saw the introduction of the gold unit in place of the Haikuan tael as the basis of duty payments. The new system, while quite fair in principle, has added considerably to the silver amount of duties on imports. Competition from countries such as Italy, Belgium, Czecho-Slovakia, &c., which formerly were not largely concerned in exports to China, is becoming more and more severe. The increasing tendency towards direct trading, the fostering of home industries and restrictive

legislation on the part of the Chinese Government are all factors which will have to be reckoned with. The days of large profits in old-established lines of trade are gone, and only the closest co-operation between the manufacturer and the agent or merchant in China can help British trade to regain its former pre-eminence.

"Everything Electrical."

The G.E.C. in 1930.

THE GENERAL ELECTRIC CO., LTD., continued to make good progress, both technically and commercially, during the past year, in spite of the prevailing difficulties. In the switch- and control-gear department increased voltages and current-carrying capacities have been catered for. A large metal-clad switchboard, with a breaking capacity of 1½ million kVA is being constructed for Sheffield Corporation. Other orders carried out during the year include 24 metal-clad units of 500,000-kVA breaking capacity for the Central Electricity Board, 39 panels of 350,000 kVA for the Glasgow Corporation, and 90 units for the Birmingham Corporation. Similar development is taking place in outdoor air-break switchgear for the British Grid and other systems. Industrial switchgear orders included one for 57 draw-out units for a large Australian mining concern. The adoption of automatic control progresses; the company has provided, or is providing, plant for automatic sub-stations for the Charing Cross Electricity Supply Co., and the St. Pancras Corporation. A scheme of automatic control has been applied to the operation of two large electrical winders recently built for an Australian mining company. The G.E.C. supplied the whole of the electrical equipment, including an 800-h.p. d.c. propulsion motor, for the E.M.V. *Cementkarrier*. A 37,500-kVA, 3,000 r.p.m., turbo-alternator has been built for the Battersea Corporation, and 30,000-kVA, 3,000 r.p.m., and 37,500-kVA, 1,500 r.p.m. sets are being supplied to the Birmingham Corporation. Overseas orders include a 20,000-kVA set for the Auckland (N.Z.) Power Board, two 8,000-kVA sets for Rhodesia and a number of 2,000-kVA sets for India. Two hydro-electric sets were constructed for the Mandeno scheme, Waitaki section.

A 10,000-kW, 3,000 r.p.m. unit and a 5,000-kW geared pass-out turbine have been supplied to paper mills. Extensive experiments in the use of pulverised fuel have been carried out and a system involving a new type of solid injection burner has been developed. Among the oil engines constructed during the year were a 1,700-b.h.p., 500 r.p.m., 6-cylinder engine driving a 6,600-V alternator for the Jaffa Electric Supply Co., and a 1,350-b.h.p. (950-kW) generating set for the Basingstoke Corporation. Increased sizes have been produced at the new transformer works at Witton and work is now in progress upon six of the 30,000-kVA, three-phase transformers for the Grid. Two 16,500-kVA, three-phase banks, with a spare 5,500-V, single-phase unit were constructed for the Waitaki (N.Z.) Power Board. Two types of on-load ratio control gear have been evolved and the larger type is being fitted to the transformers for the Grid. Two Diesel-electric locomotives for the Indian State Railways were shipped during the year. Development work relating to electrical gear for trolley 'buses has also been in progress. The equipment of 56 motor coaches for the Buenos Aires Central Terminal Railway was completed and the coaches are now in regular service. The most important order in this direction was that in connection with the electrification of the Manchester-Altrincham line upon which satisfactory trial runs have been made.

The increased demand for pearl "Osram" lamps has justified the erection of a new factory. "Osram" gasfilled lamps rated at 500-W or over are now available for use at any angle without any appreciable shortening of life. An outstanding introduction during the year was that of the hot cathode discharge tube which gives nearly twice as much light as the tungsten-filament lamp with the same electrical input and enables striking colour effects to be obtained. Considerable advances have been made in the lighting of kinema studios and aerodromes; sign lamps; internally colour-sprayed lamps; and decorative lighting. With regard to the last, mention may be made of the installations at the Strand Palace Hotel, the Trocadero, the new headquarters of the Midland Bank, India House, Aldwych and the Great Hall of the Guildhall. The company has also carried out many other specialised applications of lighting. The Pirelli-General factories have been extended by the erection of several new shops for the production of 220,000-V oil-filled cables, and an improved joint for 33,000-V triple-lead-sheath cables has been introduced. In overhead transmission work several technical improvements have been evolved. Automatic telephone developments include new director type exchanges with automatic excess-fee metering and a new type of rural automatic exchange. The company is responsible for large public exchanges in Manchester, Birmingham, Glasgow and Bristol. The overseas business in telephone equipment has expanded. In April last the important automatic service in Singapore was opened. Work has proceeded on the development of carrier-current systems. A number of important orders for industrial electric furnaces were received during the year, as well as for industrial heating and cooking installations such as those at Whipps Cross Hospital, Merton College, Oxford, the Zoo restaurant and Regent Street Polytechnic. Industrial and domestic water-heating installations have also grown in size, an outstanding example being a thermal storage installation of 200-kW capacity for heating the new showrooms and offices of the Northampton Electric Light & Power Co., Ltd. The multitudinous uses of bakelite have been added to by the introduction of a full range of bells and buzzers of various types, including pushes and indicators. The new "Magnet" luminous lamp indicator and call system has been installed in the s.s. *Empress of Japan* and *Empress of Britain*.

The company's research work has included improvements in loading coils for telephone cables, and the coils now being made for the General Post Office and other users are wound on cores to which the name "Gecalloy" has been given. The process involves new methods of manufacturing nickel-iron alloy powder, and improved methods of insulating the particles. New types of nickel-chromium alloys for heating elements have now reached the stage of commercial production. Other important research work has been in connection with the manufacture of caesium cells, the production of glasses of special and peculiar composition for the newly-developed sodium vapour discharge lamps and the introduction of large cooled-anode transmitting valves capable of handling 100-kW input.

British Industries Fair.

Exhibitors at Olympia.

In our last issue we published a list of electrical and allied exhibitors in the Birmingham Section of the British Industries Fair. We have now received the catalogue of the London Section from which we have extracted the names of 64 firms and companies whose exhibits will contain items of electrical interest. The London catalogue contains the names of about 1,200 exhibitors which, with the 800 at Birmingham, gives a total of approximately 2,000. The catalogue, as usual, gives the names in alphabetical order, and there is a separate classified section occupying 115 pages. The index to this is in nine languages—English, French, Spanish, Portuguese, Italian, German, Dutch, Swedish and Danish. The new Cotton Textile Section which is to be held at the White City, has a separate catalogue. The catalogues are being dispatched to 10,000 business men and potential buyers in Europe, Africa, parts of Asia, North America, and the east coast of South America. The publications form useful commercial directories. A list of the exhibitors at Olympia follows:—

Albion Shades, Ltd.
Artistic Lampshade Manufacturers.
Ashdown, H. E. (Birmingham), Ltd.
"Attracta" Electrical Co.
Attracta Syndicate, Ltd.
Bakelite, Ltd.
Barr & Stroud, Ltd.
Beetle Products Co., Ltd.
British Hanovia Quartz Lamp Co., Ltd.
British Motorsign Co., Ltd.
Brooks, Kenneth, Ltd.
Brown, S. G., Ltd.
Brownie Wireless Co. of Great Britain, Ltd.
Cambridge Instrument Co., Ltd.
Celebrity Gramophones, Ltd.
Chance Brothers & Co., Ltd.
Cole, E. K., Ltd.
Collaro, Ltd.
Cooke, Troughton & Simms, Ltd.
Dowsing Radiant Heat Co., Ltd.
Eastick, J. J., & Sons.
Ebonestos Insulators, Ltd.
Edison Bell, Ltd.
Electric Art Shades (1928), Ltd.
Electromaton Co.
Ellis, Simpson & Saunders.
Ever-Ready Co. (Great Britain), Ltd.
Fitz-Gibbon & Murray, Ltd.
Formo Company.
Franco-British Electric Co., Ltd.
Gallenkamp, A., & Co., Ltd.
Goring, C. & O.
Hall Telephone Accessories (1928), Ltd.
Hilger, Adam, Ltd.
Ideal Home Electrical Appliances, Ltd.
Imperial & International Communications, Ltd.
Insulators, Ltd.
Itonia Gramophones, Ltd.
Johnson, James F. W.
Johnson, Matthey & Co., Ltd.
K.F.M. Engineering Co., Ltd.
Kelacoma, Ltd.
Lissen, Ltd.
Lorival Manufacturing Co. (1921), Ltd.
M-L Magneto Syndicate, Ltd.
Marco Refrigerators (1929), Ltd.
Newton, J. M., Vitreo-Colloid (1928), Ltd.
Nobbs, George, Ltd.
Ozonair, Ltd.
Peerless Electrical Manufacturing Co., Ltd.
Pertrix, Ltd.
Read, F. O.
Rees Mace Manufacturing Co., Ltd.
Ross, Ltd.
Schulman, Philip S., Ltd.
Sheringham Daylight Co. (1930), Ltd.
Speights, Ltd.
Staines Kitchen Equipment Co., Ltd.
Strand & Interchangeable Signs, Ltd.
Telegraph Condenser Co., Ltd.
Thermega, Ltd.
United Ebonite Manufacturers, Ltd.
Waite & Son, Ltd.
Yagerphone, Ltd.

A New Transmission Pole.

Features of the Recently Introduced "PB" Steel Overhead-line Mast and Fittings.

FOR overhead lines for the transmission of electrical energy at pressures up to 11,000 V, the Electricity Commissioners' Regulations stipulate that the T-I. strength ratio of supports shall not be more than four to one. Appreciating this concession, Messrs. Painter Brothers, Ltd., have designed a steel pole which is claimed to conform strictly to this specification, thereby effecting very considerable economy in weight and price, and competing favourably with a wood pole when such factors as span lengths, wayleaves, and insulators are considered.

Fig. 1.—" PB " Transmission Line at Woodstock.

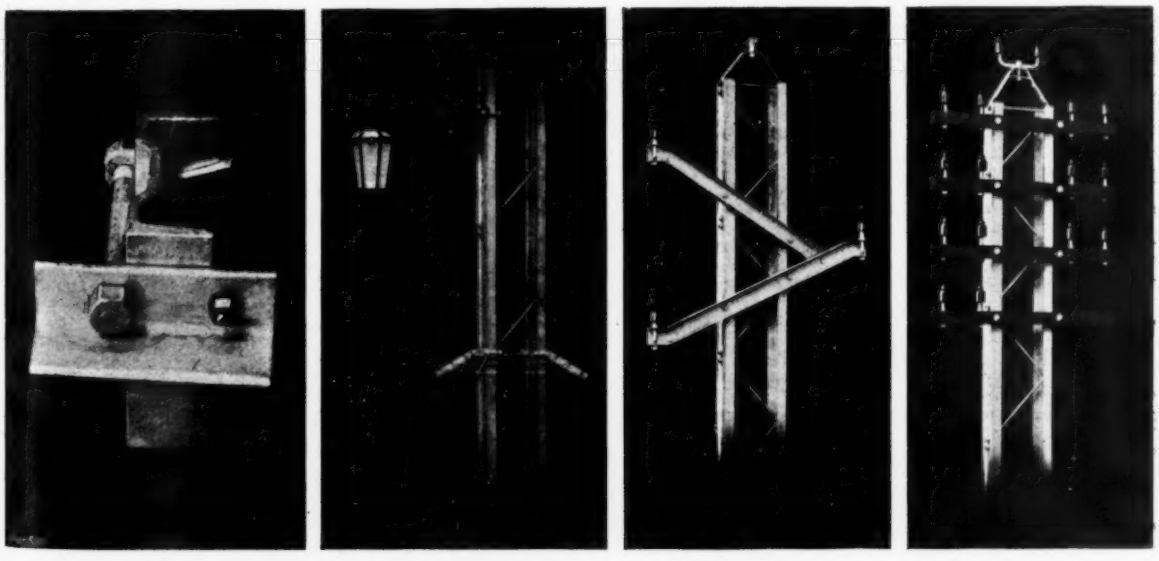
to 10 in. wide, the weight per foot of pole ranging from 13.5 lb. for the smallest size to 37 lb. for the 10-in. size. This range is suitable for anything from telegraph work up to 11,000-V power lines. The poles are supplied galvanised or treated with one coat of paint, although the makers recommend galvanising first in any case as a means of reducing maintenance costs. They lend well to the use of concrete foundations, and other features claimed for them are long life, adaptability, uniformity, and inconspicuousness in position. The last-mentioned feature is important in view of the present-day controversy on the question of disfigurement of the countryside, and the reproduced photograph in fig. 1, taken in the town of Woodstock and depicting a contract executed by the makers in collaboration with Messrs. Callender's Cable and Construction Co., Ltd., clearly denotes this point. This illustration, fig. 1, also features the neat appearance of the top of the l.p. pole. By means of additional insulators it is a very simple matter to take off side tappings. By means of a specially designed clip, fig. 2, any type of fitting, such as lamp brackets, cross arms, &c., figs. 3 to 5, can be attached at any time and to any place on the pole without previous drilling, and any type of cross arm can be therefore supplied to suit customers' particular ideas. The clip consists of only two pieces, in addition to a bolt and nut and a spring washer.

A further important point about the " P B " pole is the ease with which it can be transported; when " broken down " it takes up about half the space of a wood or tube pole.

In addition to the Woodstock work, Messrs. Painter Bros. have supplied similar poles for the China Light & Power Co., again for Messrs. Callenders, to the specification of Messrs. Preece, Cardew & Rider.

A Large Battery Locomotive.

The English Electric Co., Ltd., has recently completed an electric locomotive for the War Office, which is stated to be the largest battery-operated engine in Gt. Britain. The locomotive is of the double-bogie type for standard gauge and its weight is 31 tons. It is equipped with four motors giving a maximum tractive effort of 15,000 lb. at the tread of the wheels and 9,000 lb. on a one-hour rating. The superstructure is of the central-cab type, the batteries being contained in the two sloping ends Each battery compartment has a cover that is removable in one piece, the covers being slid off by means of chain-driven gear, so that, in spite of their size and weight, it is a one-man job to open up for examination the battery, which consists of 108 D.P. cells with a capacity of 1,000 ampere-hours at a 10-hour discharge rate. Special features of the equipment are an axle-box mileage recorder, two ampere-hour meters for " charge " and " discharge," window wipers, and heavy plate-glass windows to withstand concussion.



Figs. 2 to 5.—The Special Fixing Clip and some of its Applications to the " P B " Pole.

The new " P B " mast is a light steel pole made of a special registered section to a registered design. It has been subjected to thorough tests which have proved that the calculated loads for which it is designed allow a margin of safety. It is made in five sizes, from 3¼ in. wide

X-rays in Engineering.

Their practical value as a means of detecting and examining hidden defects in materials and workmanship.

By V. E. PULLIN.

(*Extracts from a paper read before the* INSTITUTION OF MECHANICAL ENGINEERS.)

WHILST radiology has a very definite place in engineering practice, it is very desirable that the limits of usefulness of the method as a practical test should be carefully defined, because the wrong impressions which exist in many quarters limit, and may ultimately discredit, the subject as a whole.

The application of radiology to engineering may be divided generally into (1) the examination of castings, forgings, and so on, to show flaws and lack of homogeneity in the structure, and (2) the X-ray spectroscope investigation of metals to determine the fine structure and the modifications it undergoes as a result of common engineering processes.

All materials absorb X-rays and, generally, the denser the material the more difficult it is to penetrate, but the penetrating power of the rays depends upon the voltage at which they are generated; whereas 40,000 volts would enable us to penetrate 4 inches of aluminium, it requires some 250,000 volts to penetrate 4 inches of steel. Therefore, any equipment designed to examine heavy engineering materials must necessarily involve extremely high voltages, but current consumption is very small, rarely exceeding 10 milliamperes for engineering work.

An X-ray beam consists of many different wavelengths. According to the impressed voltage, this band has a definite limit on the short-wave side; that is to say, it has a maximum penetrative value at any given voltage. Part of the beam, composed principally of the shortest of the waves, passes right through the material and emerges on the other side. Part of the beam, in encountering the atoms of the metal, suffers a change in character and is truly absorbed. Another part is deflected hither and thither in the material, and is scattered exactly as visible light is scattered by fog. Some of this scattered radiation is in turn truly absorbed, and some of it emerges in all directions from the surfaces of the transmitting medium; this component plays a very important part in practical radiography.

Radiographs are really shadowgraphs, merely a series of varying densities due to the differential absorption suffered by the rays in their path through the specimen. If there is a hole in the specimen, there will be less absorption at that place, and the result will be a shadow of *increased* blackening on the photographic plate. As we deal with thicker metal specimens, and consequently are compelled to use more penetrating radiation, the amount of scattered radiation increases. Thus, unless we can limit its effects, there is a possibility that the fog produced by scatter may ultimately destroy all useful contrast. There are several ways of dealing with the matter; we may interpose a thin metallic screen between the specimen and the plate and so absorb a large amount of scatter, or we may use a Potter-Bucky grid, which is so arranged that only the direct X-rays are allowed to pass, the other rays being cut off by suitably placed absorbing slats.

The important principle to observe is that all radiation other than the main incident beam should be prevented, so far as is possible, from reaching the photographic emulsion. In practice it is usual to cover the specimen as completely as possible with metallic lead, with the exception of the actual area under examination.

Technique is, thus, very important if good and reliable radiographs are to be obtained. There is, in fact, a danger that this valuable method of inspection may often be discredited owing to unskilful operators. It is to be hoped that as radiographic inspection becomes more generally known, facilities for training operators will become available in this country as they are now in Germany and America.

Hair-line cracks, "ghost" lines, "rokes," and so on, do not occasion any appreciable change in density of the material, and, therefore, they do not produce an X-ray shadow, but the question of the detection of cracks is entirely a relative one.

If a fine crack is directly in the plane of the rays it is comparatively easy to show it, but it remains to define the maximum angle to the plane of rays that still allows the crack to show. The depth, or shallowness, of a crack is relatively unimportant from this point of view. The deeper the crack the broader the band of shadow on the radiograph, but the width of the crack and its angle to the plane of the incident radiation are the determining factors in the relative brightness of the radiographic image, which is the really important factor. If a crack of width t is at an angle θ it reduces the effective thickness of the metal to be penetrated by an amount $t \operatorname{cosec} \theta$. The visibility depends upon angular displacement for cracks of various widths in increasing thickness of metal.

In general the result is that for shallow cracks visibility depends upon the total area of the crack. The minimum area that can be detected radiographically is 1/16,000 sq. in. in 1 inch of steel. This approximates to a crack 1/16 in. deep and 1/1,000 in. in width, or of course to a crack 1/32 in. deep and 2/1,000 in. wide.

It follows from these experiments that very fine cracks, even as fine as to warrant the appellation "hair-cracks," may be discernible by X-rays and, further, that the fundamental factor governing their visibility is their width. It will be appreciated that the appearance of the radiograph affords some sort of a guide as to the depth of a crack; but such an estimate is not reliable. If, however, a crack has really appreciable width and depth, stereoscopic technique will yield the required information. Indeed, the factor that is of primary importance in all radiographic work is contrast in intensity. We may sum up these experiments with artificial cracks by saying that, in general, a shallow crack presents the radiographic appearance of a line, whereas a deep crack of appreciable width (say 1/1,000 in.) presents the appearance of a band. On the other hand, both a deep narrow crack and a comparatively wide shallow crack present a line appearance, which shows that from the point of view of photographic contrast it is the total area that avails to produce an image when radiographing fine cracks. While it certainly is possible to show cracks of less than 1/1,000 in. wide radiographically, their appearance on the film depends upon the conditions being particularly favourable, and consequently their detection should not be relied upon in practical work.

Many examples of intergranular cracking in a steel casting would not be radiographically identifiable as cracking at all, as the actual cracks would probably have smaller dimensions than those definable as such in a radiograph. Moreover, in such cases the radiograph would very likely have a generally mottled appearance which might have value when considered as complementary to other metallurgical evidence. It should be very clearly understood that radiographic examination is expensive and, therefore, is not an economic proposition for all castings as a routine matter, although in the case of very high-grade material where lightness and soundness are of paramount importance it may even pay to conduct an examination of every casting. On the other hand, X-ray examination should prove of the greatest value in a foundry where castings of new and complicated design could be examined on the spot for weak areas and faulty technique. It is the definite experience of the author that valuable time may be saved by the use of X-rays at the appropriate moment in the foundry.

The penetrating power of the rays depends upon the voltage applied to the X-ray tube, but theoretical considerations suggest that the amount of scattered radiation will increase very rapidly at the same time; hence all useful contrast on the negative will be destroyed. It is probable that this condition may materialise at a voltage of something considerably over 300,000. An interesting experiment was, however, performed by the author which showed very conclusively that as voltages are increased up to 285,000 X-ray penetration does in fact usefully increase. It is probable that a voltage of 300,000 will enable some 6 in. of steel to be penetrated, but so far this has not been realised in a practical manner. The maximum at which it is possible to work consistently is 240,000 volts, giving a penetration of some 4 in. of steel. The desirability of examining thicker steel specimens is obvious, because the saving of labour on machining unsound material is very considerable when extremely heavy ingots are involved, and the practical value of X-rays in such cases will become more spectacular. At the same time the method has at present a very extensive sphere of usefulness if its limits are realised and it is applied with sound judgment.

The limiting factor at present in the penetration of steel is the X-ray tube itself. Tubes to work at 300,000 volts have been made, but they are not at present a practical proposition. Adequate protection for the operator and his assistants is vital, and hitherto has imposed strict limitations

on the adaptability of the equipment. "Metalix" tubes, so constructed as to be self-protecting, may be obtained for voltages up to 240,000 and lend themselves remarkably well to metal radiography. Very similar tubes are made in England under the name of the "Protexray," although designed for very much lower voltages.

A universal routine of 100 per cent. examination of castings and forgings is out of the question by reason of its cost and the time involved, but information may often be obtained from a radiograph that is unobtainable in any other way. X-ray plant could very profitably be installed in every foundry of any size, for if the first casting of a new design were X-rayed as a matter of course the weak and faulty areas would immediately become apparent and their detection would at once suggest the remedy. There is also a place for radiography in the machine shop; a flaw may develop during machining operations, and it may often be convenient and economical to ascertain its extent before proceeding with expensive work. Another application which is already in common use is the examination of assembled articles. Final assembly of such important items as fuses and similar warlike stores is now being checked by X-ray examination as a routine practice in the Government inspection departments of this country.

Actually all heavy engineering X-ray work is photographic, as visual examination by means of a fluorescent screen is not often possible. Consequently one of the chief items to consider is the cost of the film; this works out, together with development, at about 1s. 6d. per sq. ft. The capital cost of the equipment may be anything from £500 to £1,000, depending upon power and installation facilities. Depreciation is low and power running costs are almost negligible. The cost of the film may be appreciably reduced by the use of specially made sensitised paper, which has the disadvantage of requiring something like twice the exposure, but by its use the cost is reduced to about 6d. per sq. ft. Great improvements have recently been made in the manufacture of this paper, and its use in industrial radiography will probably become general.

X-rays may be used to investigate the crystal structure of metals. Indeed it is one of the most sensitive methods of detecting change of inter-crystalline orientation and grain size following heat-treatment or cold-working. This particular technique has a very definite application in the investigation of the art of welding, and the spectrograms obtained by a system which the author has developed entirely at Woolwich Arsenal Radiological Research Department afford valuable information concerning this matter. It would appear that the immediate value of X-ray research in welding is chiefly to be found in the use of spectrum analysis as an agent in the investigation and ultimate control of the welding process. At the same time its value in the direct examination of welds in small articles of great importance, such as aeroplane components, is at present well established.

Electricity Generation.

Local versus national power production; a plea for the development and interconnection of selected colliery plant with the national grid transmission network.

By E. IVOR DAVID, M.I.E.E., M.I.Mech.E.

(*Extracts from a paper read before the* NORTH-WESTERN CENTRE *of the* INSTITUTE OF FUEL, *Manchester.*)

CONTRARY to any impression of antagonism between local electricity generation and the national interlinking grid transmission scheme, the author prefers to think that there is wholesome competition, stimulating each to the best endeavour to reduce the cost of power and extend service to industrial and domestic consumers.

The advantages claimed for the national scheme are so clear that no engineer can doubt the wisdom of the large expenditure of capital now in progress in connection therewith, but electricity is not the only form of power in use in this country. In 1928 approximately 9 million tons of coal was used for the generation of electric power, but 13¼ million tons was used for locomotives, 14½ million tons for colliery boiler-houses (some of it to produce electricity), and 70 million tons for manufacturing, generally for steam raising for power purposes; that is, a total of nearly 100 million tons of coal was used chiefly for power production other than electricity. A further 17 million tons is used for gas production. There still remain some large electric power users who can produce power, due to their special circumstances, at such prices that it pays them to invest capital in generating plant and maintain the necessary organisation to operate it. The large coal-mining companies, iron and steel manufacturers, particularly when associated with coke-oven plant and the chemical industries, are the principal private producers.

The coal mines have been suggested as the proper places for super-stations for public supply. The Central Electricity Board considered this suggestion and very rightly rejected it. The place for a generating station is as near the centre of its load area as possible. If this load be a group of collieries, then it seems bad economics to transport coal to some distant station, generate electricity and transmit the power back to the collieries. The great increase in size of modern stations, coupled with such other factors as the different incidence of other industrial and municipal loads, may justify a colliery, or even a group of collieries, in taking the power from the national grid. The two essentials necessary to attract such consumers are *low price per kWh and continuity of supply*, suitable tariffs, sympathetic service, duplication of mains, interchange of supply, and other controversial matters are all secondary to these two essentials.

Factors affecting generating costs are analysed at length, the cost of colliery and well-known steam stations being compared, and reference made to the burning of low-grade fuel at collieries for the generation of electricity.

In conclusion, the author points out that colliery stations equipped with modern plant for burning cheap fuels can produce and distribute electrical power at a cost considerably lower than the generating costs of most super-power stations, and that such colliery stations could be developed and their surplus power made available for absorption into the grid system. By selecting stations for this purpose and installing the necessary plant, low-grade fuel which would otherwise be lost to the nation could be used to advantage. Industrial stations which require high-grade fuel, or have inefficient generating plant, should link into the grid system and either shut down altogether or use their plant to ease off their peak loads, and so reduce their maximum demands and thus their total kWh cost, at the same time improving the load factor of the grid.

A.C. Meter Maintenance.

An outline of the apparatus and routine methods employed for the detection and prevention of inaccuracies in large energy meters in the north-east coast area.

By E. FAWSSETT, M.I.E.E., and G. E. MOORE, A.M.I.E.E.

(*Summary of a paper read before the* METER AND INSTRUMENT SECTION *of the* INSTITUTION OF ELECTRICAL ENGINEERS.)

ELECTRIC power supply under one direction to mining, shipbuilding, engineering, and general manufacturing consumers on the north-east coast, extending over an area exceeding 4,000 sq. miles has, by reason of its magnitude, led to the development of special methods for maintaining the meters in as accurate a condition as possible. The system of supply is almost always 3-phase alternating current at voltages ranging from 20,000 downwards, and 2-element polyphase meters are employed in the majority of cases. A certain amount of energy is supplied as direct current, but the maintenance of even the best of the existing d.c. meters is a much more difficult problem, a lengthy experience of which has not produced any very satisfactory solution, other than replacement by the most modern type, now so improved that one could maintain it with some expectation of continued high accuracy. While high-class single-phase meters can in the main be relied on to run for a term of years without loss of accuracy, the revenue involved in the registrations of individual large power meters, as well as the greater risk of trouble, call for periodic inspection and test, apart from attention to such faults as are reported after the weekly readings have been taken. The cost of this work, which is in the nature of an insurance premium, is remarkably small in comparison with the revenue.

Routine visits are made by readers, maintenance staff, and district operating engineers, all of whom, from knowledge of the conditions, are in a position to detect irregularities. It is the aim of the staff to prevent the occurrence of faults, but immediate detection on occurrence is the next best thing, and reliance is placed on a commonsense interpretation of weekly readings and reports. Faults are both electrical and mechanical and the more usual ones are detailed in the original paper.

Routine maintenance visits are undertaken for verification of accuracy and can be thoroughly justified, whatever the result. The interval between tests, considered as an insurance against the occurrence of error, should be based on the probability of trouble, so that single-meter installations should receive more frequent attention than those having two or three meters integrating the same measurement; also, large meters should be examined more often than small ones, since for a given departure from correct registration there is a greater possible loss in money to set off against the cost of examination.

As ready reference to all particulars concerning each meter is necessary, a consumers' file of large cards containing the whole history of, and every test on, each meter is supplemented by a smaller file containing the systematic visits for each year. An annual programme is in effect a series of long day trips mapped in such a way as to follow as economic a plan in car

mileage as possible, spread over large portions of three counties. In addition, fault reports come in continuously, but as far as possible the visits which these entail are combined with the programme. Loose-leaf books are used on the actual work, the sheets afterwards being bound together under each year, as the direct record, without any transcription, of all work done.

As practically the whole of the switchgear in the area is of the ironclad type, the metering current transformers are not easily accessible. This is of no great importance from the metering point of view, as the ratio and phase angle of these transformers are well maintained over a long term of years. During a period of more than 20 years there has only been one case of a meter current transformer in ironclad gear failing for a reason not at once evident, so that this risk can be written off as negligible. Potential transformers are contained in oil-filled tanks which can be dropped for inspection; this is very necessary, as potential transformers have a very much worse record than current transformers. The faults experienced, other than fuse troubles, are usually between-turns breakdowns on the high-pressure windings, generally developing into a fault sufficiently serious to heat the oil to the danger point, the current flowing being often insufficient to blow the high-voltage fuse. In fact, these fuses are more troublesome than protective, and 20-kV transformers are now being installed without them.

Permanent provision is made for inserting check-meters by including in the equipment a testing board consisting of two parts, one for current and one for pressure connections. Some 40 portable 2-element check-meters, having characteristics similar to those of the permanent instruments, are in constant use in the area. A car is used for all visits, and the instruments, all clamped, are carried on the rear seat, where they are protected and retained by a special cover. The car also forms a readily accessible storehouse for the almost innumerable adjuncts which long experience suggests may be required. The unusual part of the equipment, which enables a complete examination of the meter to be carried out whatever the consumer's load may be, is described in some detail in the original paper.

As regards the cost of all this work in relation to the revenue safeguarded, the average revenue from an installation of the type considered is £3,000 per annum, and the cost per installation of the necessary staff, material, and transport, including general supervision, averaged over the whole of the installations in the area, amounts to only £2.73, or 0.091 per cent. of the revenue, which is a very reasonable outlay, considered as an insurance that the correct revenue is being obtained; it includes, in addition, the cost of attending to all faults, which cannot easily be separated from the cost of routine testing alone.

Acknowledgment is made to the Newcastle-upon-Tyne Electric Supply Co., Ltd., for permission to publish this record of experience gained on its system, and to Mr. T. C. Richardson for valuable assistance with the development of the special apparatus and the routine described.

Electrical Accidents in Mines.

Review of the Report of H.M. Electrical Inspector of Mines for the Year 1929.

THE issue of the annual report of H.M. Electrical Inspector of Mines, Mr. J. A. Bernard Horsley, for the year 1929 was reported in last week's issue of the ELECTRICAL REVIEW, and a short summary of its principal features was given. Our readers may be interested to read this report in conjunction with the annual reports of the Secretary for Mines and H.M. Chief Inspector of Mines issued early in September.* The number of mines at work was once more diminished, the total being 2,419 as against 2,539 in the preceding year. Nevertheless, the horse-power of motors in use was once more increased, by approximately 11,000 above ground and 20,000 below ground. The proportion of a.c. motors was 80.5 per cent., about the same as in 1928.

Fatal Accidents from all Causes.

The 11 separate fatal accidents attributable directly or indirectly to the use of electricity involved the loss of 19 lives and caused injury to five other persons. These accidents were due to two causes, *i.e.*, shock and ignition of fire-damp. In ten of the fatal accidents one man was killed in each case from shock. The other accident was a fire-damp explosion due to sparking in a coal-cutting machine, the enclosure of which had been negligently maintained, and killed nine and caused injuries to four other men. Table I gives a list of the principal causes of fatal accidents over nine years; Table II sets out the nature of the equipment involved; and Table III relates the number of deaths in 18 years due directly to electric shock below ground to the horse-power of motors installed. In 1921 and 1926 many collieries were idle for three months and six months, respectively.

TABLE I.

Year.	1920	1921	1922	1923	1924	1925	1926	1927	1928	1929	Totals.
A. Electric shock, and/or arc burns	8	4	8	11	12	7	3	7	11	10	81
B. Ignition of fire-damp	1	1	1	2	2	1	1	1	4	1	15
C. Fire, arising from electrical defects	—	—	—	—	—	—	—	1	—	—	1
D. Other causes ...	2	—	1	1	—	—	—	2	—	—	6
Total	11	5	10	14	14	8	4	11	15	11	103

TABLE II.

Apparatus.	1920	1921	1922	1923	1924	1925	1926	1927	1928	1929	Totals.
Switchgear and fuses	2	1	4	6	4	1	1	4	4	1	28
Flexible cables and plugs	2	—	2	1	6*	1	1	3*	6	6	28
Overhead lines, bare or insulated	2	2	1	1	1	5*	—	1	1	1	15
Unarmoured cables and wiring-in conduit	—	—	—	—	—	—	—	—	—	—	—
Lighting accessories	3	1	—	1	1	—	1	1	—	—	8
Motors and transformers	—	—	1	2	—	—	—	—	—	1	4
Coal cutting machines	1	—	1	1	—	—	—	—	—	1	4
Totals	10	4	9	12	12	7	3	9	11	10	87

* Two persons killed in one accident.

TABLE III.

Year.	Number of deaths.	H.p. of motors (Thousands).	Year.	Number of deaths.	H.p. of motors (Thousands).
1912 ...	7	317	1921 ...	1	645
1913 ...	13	371	1922 ...	6	688
1914 ...	4	420	1923 ...	9	753
1915 ...	8	469	1924 ...	13	811
1916 ...	4	482	1925 ...	3	840
1917 ...	2	522	1926 ...	2	852
1918 ...	6	549	1927 ...	7	878
1919 ...	6	587	1928 ...	7	898
1920 ...	3	619	1929 ...	9	918

Firedamp has been responsible for about 15 per cent. of the fatal accidents during the past ten years, but the measure of the risk actually incurred by the use of electricity under existing conditions is better indicated in Table IV, which shows that electricity has been responsible for less than 3 per cent. of the total accidents, 10 per cent. of the number of fatalities, and 5 per cent. of non-fatal injuries during the decade.

The accidents mentioned below have been selected from the report.

Fatal Accidents Due to Electric Shock.

Blantyreferme No. 3, Lanark.—A pan-shifter, while engaged with another in re-erecting a shaker conveyor at the coal face, the inclination being 1 in 7 and the place only 2 to 2½ feet high and very wet, was killed by electric shock from one of the pans, which had been allowed to ride over a trailing cable carrying current to a coal-cutting machine.

The cable had been placed inside a newly-built portion of the conveyor, from the end of which it passed to the floor where it lay along the path of the conveyor.

The trailing cable, which was of the usual cab-tire sheathed type, had been in use for two months and it was in good condition, but the square edge of the steel pan had cut clean through the sheath and the insulation so as to make contact with one live core. The system was 3-phase at 440 volts, the neutral point being earthed.

* "Electricity in Mines," ELEC. REV., Sept. 12th, 1930.

There are three ways in which such accidents can be prevented, *viz.*, by prohibiting pan shifting in the vicinity of a live trailing cable, or by using a trailer with an earthed metallic screen surrounding the live conductors, in conjunction with "leakage protection," or by ensuring that the cable shall be suspended out of harm's way.

The first is entirely a matter of organisation and is preferable on the ground that it leaves nothing to the workmen.

TABLE IV.

Cause.	Separate accidents in 10 years.	Number of persons Killed.	Injured.
Naked lights	572	88	739
Matches and smoking ..	20	20	34
Shotfiring	47	111	103
Electricity	22	38	54
Other causes or unknown	49	132	140
Totals	710	389	1,070

The second involves the use of a more mechanically complex type of cable, but it is one that should remove the risk of shock from the cable under other circumstances as well. The last appears the simplest solution, but it is probably the most difficult to enforce.

Grange and Bradgate Colliery, Yorks.—An experienced coal-cutting machineman in charge received a fatal electric shock from the trailing cable, or possibly from the plug, which he had withdrawn from the machine without first switching off at the gate-end in order to reverse the motor.

The electrical system was 3-phase at 500 volts and the neutral point was earthed.

The machine after cutting 18 yards had "stalled" because some loose timber had been drawn in by the chain and had become firmly wedged. Deceased thereupon switched off the motor. Current was then cut off at the gate-end switch and deceased was found unconscious and sitting with his back against the cutting face but clear of the machine and cable. Artificial respiration was begun as soon as the body had been brought into the adjacent gate road and was continued for 1½ hours under a trained ambulance man, but without any response.

The trailing cable came down the face to the haulage end of the machine and the plug attached to the cable was found resting upon the top of the machine frame. It appears probable that deceased intended to reverse and re-insert the plug preparatory to reversing the direction of the chain in order to free it from the obstruction that had caused the motor to stall. There was no reversing switch in the machine.

No defect of insulation could be found in the machine, plug, or cable, but there was a narrow groove in the bore of one of the fibre bushes on the plug, which was of the flat bat type, whereby the contact pins entered the contact tubes. Experiment proved that this groove could only be reproduced by mechanical scraping, for the surface of the groove was lined with fibre. A groove produced on fibre by the passage of electric current, through water, exhibits a blackened surface and is smooth. This is mentioned because it was surmised at first that deceased grasped the end of the plug, and that water dripping from his hands completed the electrical circuit through the bushed opening. The medical evidence was that there was a burn in the palm of the right hand covering three fingers, the seat of the burn being the third joint of the middle finger. The circumstances are consistent with a burn and shock received from the end of a fragment of loose wire that may have pierced the cable from outside when deceased took hold of the bight of cable to lift the plug off the top of the machine.

The cable had been moved and handled by various persons before this explanation had been suggested and subsequent attempts to find such a fragment of wire or to locate the puncture failed, although that part of the cable which would have been within reach of deceased was tested, after immersion in water for a night, with alternating current at 2,000 volts. It was found, however, that punctures made deliberately with a small wire nail were self-sealing, owing to the elasticity of the rubber sheath, and were not discovered by testing in water with high voltage.

It was an order at this mine that plugs should not be withdrawn, or inserted, while pressure was on the trailing cable but upon such an occasion compliance would have entailed a double journey to the gate-end switch, totalling 600 yards if the machine man travelled by the gate road, or of 360 yards if he travelled by the face. The plug was interlocked mechanically with the machine switch to prevent the use of the plug as a switch, but it was intended to be used for transposing the connections, for there was not a reversing switch in the coal-cutting machine.

If it is desired to prevent withdrawal of a plug while the cable is live, this can be ensured by the adoption of an electrical interlock between the machine and the gate-end switch. The complete solution, however, is to be found in "remote control" of the coal-cutting machine motor, *i.e.*, in the use of a contactor type of starting switch in the gate road controlled, through a pilot conductor in the trailing cable, by a small switch on the machine. Such "remote control" would save the time that must otherwise be lost in journeys between the gate road and the machine.

In view of the probable cause of this accident, *viz.*, puncture of the cable sheath and dielectric by a stray fragment of wire, it is suggested that the ideal is a type of cable that comprises an earthed metallic screen surrounding the live conductors.

North Seaton, Northumberland.—An assistant coal-cutting machine man having stopped the machine, by switching off, preparatory to resetting the jockey haulage proper, received an electric shock from the haulage rope which had become live, because the insulation of the plug connector, which was in position in the machine, had broken down on one phase of the 3-phase 625-volt system which was operated with the neutral point earthed. The plug connector was of the flat bat type and the insulating facing appeared to be sodden; it had broken down between one contact tube and the metal case and there was some evidence of arcing at this point. The insulation of the corresponding contact pin on the machine had also broken down. The result was that the machine and the haulage rope became live. There were five lengths of trailing cable totalling 450 yards, coupled by plug and socket union, between the machine and the gate-road switch. The resistance of the earthing conductor, as tested between the machine and the gate-road switch was in the region of 30 ohms, this high resistance being due to one, or more, of the earthing contacts in the plug boxes. There was no real need for so long a trailing cable which had been taken to the face by devious ways instead of extending the armoured cable.

The fuses in the two switch boxes were of 19 S.W.G. copper wire and these were not blown. There would appear to have been no systematic testing of the earthing circuit comprised in the trailing cables prior to the accident. The arrangements for carrying the current to the advancing machine cut face are a deplorable example of unintelligent expedients.

Coupled lengths of trailing cable are generally unnecessary. The working length can be limited to little more than that necessary to span the machine travel and the surplus length of cable that is required to follow the advancing face could be provided as a pliable armoured cable, flaked in a figure of 8 on a light double bollard, between the permanent roadway cable and the switch controlling the trailing cable. Standardised cable-end coupling boxes are an important detail in the proposed equipment. They are introduced to facilitate rapid connection and disconnection of the various "make up" lengths of cable, and they are intended to take the place of the usual cable jointing boxes. By the use of these cable end coupling boxes, which should be attached to the cable before it is taken into the mine, cable jointing *in situ* is avoided. The principle of these boxes was suggested in a paper read by Mr. Horsley on November 22nd, 1924, in Glasgow, before a joint meeting of the Mining Institute of Scotland, the Colliery Managers' Association and the Association of Mining Electrical Engineers (the *Mining Electrical Engineer*, Vol. V, No. 53, February, 1925).

Mossbeath Colliery, Fife.—A fireman, while in the vicinity of a small auxiliary ventilating fan coupled to a 10-h.p. squirrel cage 3-phase motor, received a fatal electric shock from some part of the structure, which was charged intermittently by defects in the insulation of the stator winding of the motor. The electrical system was 3-phase at 500 volts, the neutral point being insulated.

Insulation tests of the electrical apparatus did not disclose any defect, and it was established that the circuit was not opened automatically. When, however, the fan and motor were dismantled several serious electrical and structural defects were found. The insulation of the end turns and cross connections of the stator winding of the motor had perished, and at several places the copper conductors were visible. These windings projected so as to be pressed by the end shield plate of the motor, which carried the outward bearing. There was also a bare place on one of the connecting cables between the winding and the terminal box, which may have touched the frame intermittently. Several of the rotor bars were loose in the slots and the solder had run out. The fan propeller shaft was carried by a single bearing, being overhung, and this bearing and the shaft were so much worn that the fan blades rubbed on the fan casing.

Tests were made of the conductivity of the earthing conductor, after attending to various bonds on the armouring of the cable in the circuit, with the following result: resistance of 2 cores of the cable, 2.594 ohms; resistance of cable armour, 5.24 ohms; relative conductance of cable armour with respect to one core, 25 per cent. After giving further attention to the joints and bonds of the cable armour the resistance of that part was reduced to 4.70 ohms which, however, gives a relative conductance of only 27½ per cent. as compared with a minimum of 50 per cent. that is required by Reg. 125 (b).

The motor was an old one and it appeared to have been broken down and indifferently repaired previously, but its recent history is illuminating. The fan and motor had been in use at another pit in the same ownership, and on July 26th it was sent to Mossbeath where it remained at the surface until August 13th, covered by a tarpaulin and sacks.

After overhaul by a mechanic and an electrician, who tested the insulation and ran the motor experimentally, it was installed in the mine and set to work, but the insulation of one-phase winding broke down. A bare place on the winding was found behind the end shield, and after taping this the

electrician re-started the motor; three days later the fatal accident occurred. It is evident that neither the fan nor the motor was in a fit condition for use when the plant was taken into the pit.

The Fife Coal Company has established a fully equipped workshop for the overhaul and repair of such machinery, and it was the intention that all used plant should pass through this workshop before re-issue, but in this instance, as has been shown, this sound routine was evaded. As the neutral point of the 3-phase system was not earthed, the fuses and other circuit-opening devices were not operated when the insulation broke down. It should be recognised that, while efficient earthing is necessary, it is no less important that on the occurrence of a fault the faulty circuit should be cut off automatically and, as near as may be, instantaneously. A necessary condition of such automatic isolation is the earthing of the neutral point of the system.

(To be concluded.)

Cable Troubles.

A Discourse on Cable-laying and Maintenance Practice, with a View to the Prevention of Faults.

By L. R. LEE.

(Extracts from a paper read before the London Technical Group of the ELECTRICAL POWER ENGINEERS' ASSOCIATION.*)*

IT is with direct-laid cables that most of us, in the future, will be troubled, and in thinking of such it is the mechanical details that must receive first consideration. Our great safety anchor in this consideration is the armouring of the cable, and I am now wholly in favour of wire armouring, which gives very great added mechanical strength to a cable, helping the cable in the event of subsidence and against the effects of street vibration. The wire armour of the cable must be continued somehow in its full strength across each service or joint box; there must be no great movement independent of the armour at each joint, as the result would be the breaking of the lead cable sheath at each plumbed wipe. The armour must take the variations of the vibrations.

With regard to the prevention of faults on 33-kV cables, I am of the opinion that no one has yet sufficient experience to enable him to say very much of a helpful nature, particularly with regard to belted-type cables. One would suppose, however, that an oil-pressure system attached to the cables would go far to eliminate faults due to corona and ionisation.

One of the greatest assets for the prevention of faults is a highly-developed power of observation in the supervising engineer, and there is probably no better training for this than a study of drawing in all its branches. With regard to faults due to external damage, there is, I think, nothing that can be done to eliminate entirely their possibility. Anyone opening the ground can, if he pleases, remove any sort of cover which had been placed over the cable. The cover which will probably be found of service is a creosoted plank at least two inches thick, and in width twice the diameter of the cable. These planks should be as long as possible to prevent their being taken up. On large networks it is good practice for any one utility department to give all the others notice of any intention to open the ground. These notices can be received and given out by a central authority. Notice of rebuilding operations can be treated similarly. It will probably be found to pay well to employ one or more inspectors having a knowledge of cables and cable laying, whose duties are to visit all sites covered by the notices above mentioned. These inspectors can take preliminary steps and report later to their supervising engineer who then has the matter in mind.

As a means of warding off the results of incipient faults by finding them before they have had time to develop—such faults as are caused by the ingress of soil water to a cable or a joint box—there is probably no better way than by carrying out periodical insulation tests. On a l.p. system in which the neutral conductor is earthed, the point of earthing is provided with a switch link, and if this is opened momentarily, current and voltage readings can be taken and used as an indication of the state of the network plus its then connected consumers' installations, in the manner devised by Mr. Groves, of Birmingham. The results obtained can, wanting a better term, be called "ohms," and for a network covering, say, one sq. mile or so, a reading of 20 "ohms" would indicate a network in fairly good condition. These tests ought to be repeated nightly after most consumers have shut off their installations. If the result is less than the original figure obtained and logged as satisfactory, then the network should be gone over piecemeal until the cause of the lower test is located. This form of testing has been used in Manchester for very many years and has resulted in the location of hundreds of incipient faults, some of which at the time of location were passing only half an ampere to earth.

It may be as well to say as a warning that in a test of this description if the readings obtained are C=0 and E=0, then the resulting R may be either 0 or well on to infinity. Such readings are frequently the result of heavy balanced earths on the network. In such a case, a temporary fault through a resistance of known value should be made on the network and the true resistance calculated from the result obtained. By the continual use of the above test one gets to know one's network intimately. Again, for maintaining a lot of e.h.p. or l.p. feeders in good condition there is nothing to beat insulation testing at least once every month. The repeated tests should give the same value as obtained on the cable before laying. With such testing, faulty joint boxes with water in them may be found and cut out long before they would actually break down.

Discussion.

Mr. D. A. S. Porteous (chairman) said it was possible that corrosion trouble might be due not so much to tar acids in the wrappings over lead sheaths as to obnoxious matter in the surrounding soil. As to street vibration causing the lead to become crystalline, lead was always crystalline, whether it was in a defective condition or not, and what really happened was that in a cracked cable the crystals became dis-associated. Although voids were not so obvious in single cables as they were in the belted type, and that three single cables was satisfactory, if properly made, the H type of cable was an improvement.

Mr. Henwood deprecated the v.b. cable system laid in wood troughing, and referred to a scheme in which all cables drawn into ducts were lead sheathed served with "Ozokerite" waxed braiding. A point with regard to that wax was, in the event of a cable warming up, would the wax melt and stick to the porcelain or earthenware, and so give trouble if it was desired to pull the cable out.

Mr. Ellis referred to a change-over from d.c. to a.c. on a l.p. system employing v.b. cables which, at the time of change-over, were full of water, and within two hours faults occurred at the joints. The joints were opened and re-connected temporarily, so as to allow the water to run out, and within 24 hours the cables were found to be quite dry. The conclusion he had drawn from that was that a.c. helped in driving the water out at the weakest points.

Mr. Brierley, referring to the use of bitumenised paper over cable armouring, thought that the hygroscopic nature of the paper would probably assert itself and give worse trouble than in the case of a cable which had no paper on it at all. Such methods appeared to be asking for trouble.

Mr. W. F. Andrews (hon. secretary) said that cables with paper immediately over the lead had worked satisfactorily across the entrance to a Regent's Canal dock for something like 20 years. In his opinion the best system for laying cables for avoiding faults was the good old-fashioned solid system. It was perhaps the most expensive, but with something like 31 years of experience with cables laid on the solid system he had had very little trouble. His department still more or less designed its own cables, with 10 per cent. more lead than the B.E.S.A. specification, and in that way they had found it possible to use a plain lead cable without any serving at all for feeder work. Instead of building manholes and boxes in the street to pull cables through, his undertaking had definitely marked places where cables were pulled through, and after the cables were joined the places were filled with molten pitch and the ground covered in on top. Some 25 or 30 years ago armoured cables were laid direct in the ground in his district, and no great care was taken to see there was a good bond between the lead sheath and the armouring, with the result that there were very serious troubles. They hoped they had got over that now by making sure that a really good bond existed between the lead and the armouring.

Mr. Morley disagreed with the author on the question of flaking. With the congestion in modern streets to-day it was impossible to cut a cable to avoid flaking, and if it was done fairly well it was not injurious to the cable.

Mr. Hilling mentioned that the cables being laid in his district by the Central Electricity Board were single cables laid 3 ft. or 4 ft. deep, well protected on top with concrete covers, but without protection at the sides, and he anticipated trouble from boring machines. There were 15,000 services in his district, all of which were armoured, but the armouring was not bonded, and he did not remember a single fault on that account. He also disagreed with Mr. Andrews as regarded flaking; the cost of a joint on a 1 sq. in. cable was £6 or £7 and he had worked out the time of 30 men for half an hour's flaking at about 22s. 6d., so that there was a difference of £5 or £6.

Mr. Edge said the majority of v.b. cable troubles were due to over-loading more than to anything else. He preferred to use two one-inch boards and overlap the joints, instead of two-inch boards, as he found that this made a better job than with single heavier boards. In Ipswich they started changing over to a.c. 14 years ago and had been fairly fortunate in not having any large number of faults after the change-over, and that confirmed what a previous speaker had said, namely, that a.c. mains were less liable to faults than d.c. ones. A certain amount of flaking had to be done, particularly with small cables in congested streets, in order to avoid a very large number of joints. At the same time, flaking must be carried out with discretion.

Mr. Henwood referred to an instance of vibration on cables running over a railway bridge being removed by the use of felt pads under the cable.

Mr. Taylor said that braided cables caused a lot of trouble. He had found that out of about 60 lengths of cable in iron pipe it was only possible to draw out 15, because the braiding rucked up and absolutely prevented the cable being drawn out.

Mr. Harmer said that undoubtedly untreated wood lasted longest if air was kept from it. Whilst crystallisation of lead generally was important, crystallisation of the porous metal used for the wiped joint was even more prevalent, and he could not understand why in that part of cable work they slavishly followed the plumbers. Why not use a hard solder at the joint?

Mr. Fernie asked if there really was any expansion of lead in h.p. cables. A paper was read a year or two ago by Mr. Beaver, in which it was pointed out that although people talked glibly about the expansion of lead in h.p. cables, experiment had proved conclusively that it did not occur. That statement had never been disproved.

Mr. J. H. C. Brooking, who read the paper in the absence of the author, in reply to the discussion, said that in America there was published every year a list of faults and details of troubles relating to 60 of the principal supply undertakings. If in England they would follow on similar lines it would help considerably. Wire armouring was largely used by some of the principal companies in the metropolis for drawing-in, and it was possible to draw-in long lengths round awkward bends in a manner which lead-covered cables did not permit. In his own long experience of cable laying there had been a great deal of work to be done where flaking appeared to be the only thing, because joint boxes could not be obtained; therefore, he flaked as much as possible, but he only did it because he was fortunate in having a good foreman. The Admiralty used a "crystalline" lead almost exclusively on torpedo boats, but he would not recommend it for everything, because, whilst it did not easily crystallise, he understood that it cracked when it was bent, and that might be a source of trouble with cables. He believed stoneware covers were about the handiest things that could be used for cables, and they could very often be made by the local electricity department. There had been more trouble than enough from electrolysis and bad faults on cables due to wires not being of sufficient area, and if a cable was bonded it must be done so that a bond would not burn off or break off.

New Electrical Devices, Fittings, and Plant.

Readers are invited to submit particulars of new or improved devices and apparatus for publication in this section.

A Novel Plug and Socket.

A plug and socket which has been adopted by DOMESTIC ELECTRIFICATION, LTD., Townsend House, Greycoat Place, S.W.1, for the connections throughout its cookers presents some novel features. The pin itself has four longitudinal slots extending nearly the whole of its length, and it is hollowed out in the centre. These slots allow a certain amount of spring in the pin to ensure good contact in the socket. To accomplish this, the socket is drilled to a diameter approximately three-thousandths of an inch less than the diameter of the pin. The result is a very soft, velvety movement when the pin is being inserted. The socket shown in fig. 1 has been partially cut away to demonstrate the perfect contact over approximately 80 per cent. of the surface of the pin. It is the usual custom of the company to mount the sockets on the elements themselves, whilst the pins are mounted on the frame of the cooker, care being taken to locate these at the coolest possible points. Tests have been taken to determine the actual maximum heating effect on the pin and socket under the worst conditions, namely, leaving a 2,000-W, 100-V element on circuit for some hours

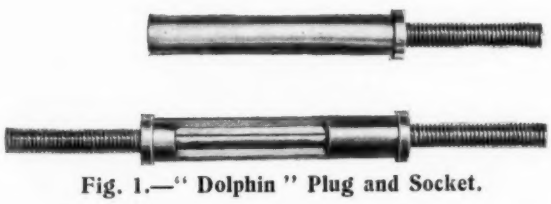


Fig. 1.—"Dolphin" Plug and Socket.

at full load. The maximum temperature attained under these conditions was 170 deg. C., which is well below the oxidising temperature of the metal of which the pins are constructed.

New Ironclad Fuseboards.

The accompanying illustration, fig. 2, depicts the construction of "Sanderac" fuseboards, a range of which has been produced by Messrs. WM. SANDERS & Co., Falcon Electrical Works, Wednesbury, to meet the exacting demands of modern conditions. The range includes eight models, providing for two, three, four, five, six, eight, ten, and twelve ways. The fuseboards are rated in accordance with B.E.S.A. Speci-

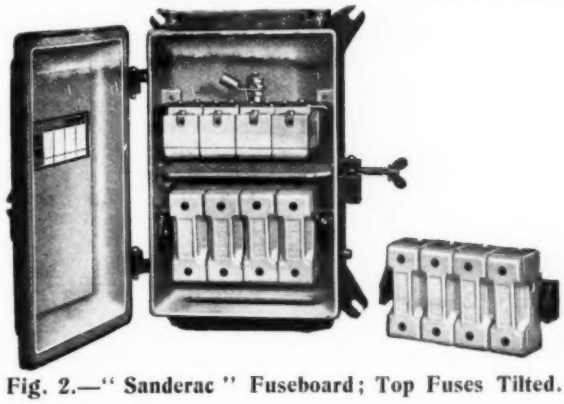


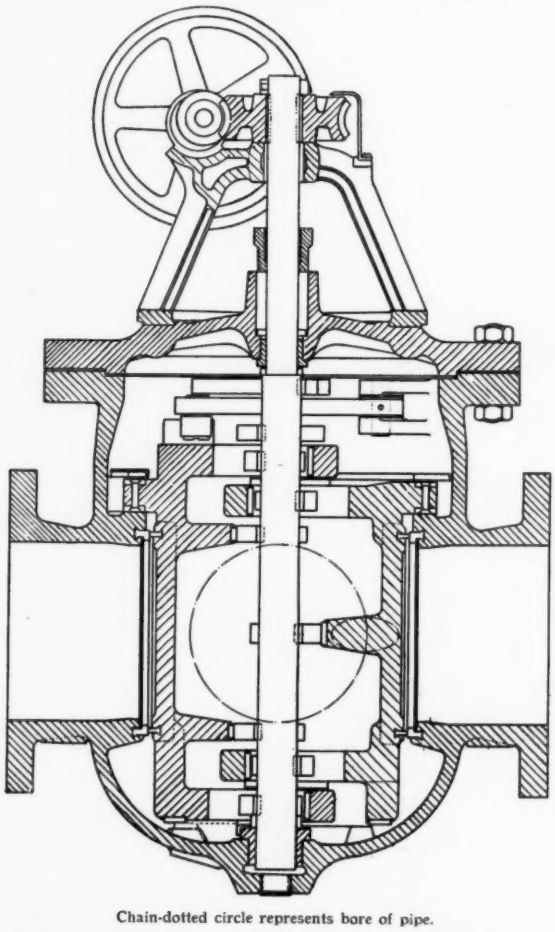
Fig. 2.—"Sanderac" Fuseboard; Top Fuses Tilted.

fication No. 214, and the fuses with which they are fitted comply with the standards of performance laid down in B.S.S. No. 88. The units are mounted on tilting and immediately removable steel battens, enclosed in cast-iron cases, lined with white insulating enamel. Each bus-bar is equipped with a substantial terminal, and the tilting feature greatly facilitates the connecting operations, see fig. 2. The fuse carriers have dual clips, which, in conjunction with self-aligning pressure contact base clips, work on a current density of only 50 amperes per square inch of surface. To facilitate drilling on site, the cases are provided with easily removable soft grey iron end plates. Ample room is allowed everywhere for the manipulation of cables.

A H.P. Steam Valve.

For the use of all the patents and the manufacture and sale of the "Karnath" rotary h.p. steam valve, Messrs. ALEX. TURNBULL & Co., LTD., St. Mungo Works, Bishopbriggs, Glasgow, have acquired the exclusive rights for the British Empire. The valve is entirely new in design and construction, and some special and advantageous features are claimed for

it. The disk (or disks) is first of all drawn back from the seat in a parallel direction by means of cams, and thereafter by the action of another cam and the same movement of the hand-wheel it is rotated through 90 deg. into the cavity formed by the circular body, thus leaving a fullway passage for the steam. This is directly opposite to the movement of the ordinary type of full-bore valve, in which the disk is drawn up against the seat. In the "Karnath" valve there is no rubbing or wear, and as a result there is no leakage between the seat and faces. Further, the amount of power required to open the valve is considerably less than in the usual full-bore valve, and additional advantages are that, as there is no rising spindle, the amount of headroom required is considerably reduced, and gland trouble is negligible. When opening the valve the disk (or disks) is in the first place only moved a short distance away from the seat in order to pass just sufficient steam to warm up the piping, &c. After this is done the valve is opened out full; thus no by-pass valves are required, and a further advantage is gained. It should also be noted that there are no internal springs, and that only simple and robust parts are included in the steam space. In its several types the valve can be made: to open slowly and close



Chain-dotted circle represents bore of pipe.

Fig. 3.—"Karnath" H.P. Steam Valve; Section.

slowly; to open slowly and close slowly or quickly, as desired; to open slowly and close quickly (in one revolution of the hand-wheel, by hand, pulling a rope or automatically by pressure gauge switch). The closing operation can be effected in as short a time as 1 sec. The accompanying illustration, fig. 3, is a sectional drawing of the standard (slow closing) valve.

The valve is also well suited for remote control, and a completely automatic electrically controlled equipment has been devised which is simple and efficient in operation. The 1-h.p. motor is mounted on an extension of the cover, and drives the valve spindle through gearing. The control is by push button and relay mounted on a control board situated at any convenient position. "Karnath" valves are at present in use for pressures up to 1,400 lb. per sq. in. and temperatures of 850 deg. F.

Large Self-cooled Transformer.

A large transformer recently built by the SWEDISH GENERAL ELECTRIC CO., LTD., for the South Swedish Power Co., presents some interesting features. It has an effective capacity of 45,000 kW and is designed to step down from 126,000 to 57,500 and 52,500 volts. An outstanding feature is that it is self-cooled, using neither cooling water nor compressed air to carry off the heat generated when in operation. The total weight of the unit is 328,000 lb. and its height is about 28 feet.

Reviews.

Telephone Theory and Practice; Theory and Elements. By KEMPSTER B. MILLER, M.E. Pp. xiv+486; figs. 272. London: McGraw Hill Publishing Co., Ltd. Price 25s. net.

Those who remember the author's "American Telephone Practice," which appeared thirty years ago, and its last revision of twenty-six years ago, will gladly hail the appearance of the present work. Confronted with the fact that, with the changing times and the amazing development of the art of telephony, a revision of the older work which would adequately deal with the new order of things would, to quote the author's words, have been "akin to the tail wagging the dog," it was decided to prepare an up-to-date successor that would deal with present-day telephony in the same simple way. The work in its entirety will consist of several volumes of which this is the first. It is intended "not only for the student and the beginner in telephone work, but also as a general reference text book for the more advanced." The present volume of three parts contains 16 chapters. Part I deals successively with Man's progress in communication; precursors of the electric speaking telephone; its early history; the telephone system. Part II (on elementary theory) discusses the vibration of sound; the sensation of sound; the kinds of sound; voice currents; vacuum-tube theory; and magnetic materials. Part III is devoted to wires for equipment use; coils and electromagnets; resistors; condensers; flexible cords; points and contacts. From the foregoing epitome of the matter dealt with, it will be seen that the author has covered a fairly wide field; but the lucidity and thoroughness of exposition in no wise suffer from that fact.

The earlier chapters give, in chronological order, brief details of the various developments that have taken place from time to time in bringing the science and art of telephony to its present stage of efficiency.

From the first telephone of Bell, with its 50 feet of wire as its transmission limit, we now have 33 million instruments in use, and the mileage of wire, in the United States alone, exceeds 62 million miles. Telephone "transmitters" have come and gone; they have had their day and ceased to be; but it is comforting to know that to-day, although our modern "transmitters" differ greatly in their forms, they are all the same in principle as the granular-carbon instrument devised by the English clergyman, Hunnings, fifty years ago.

Chapters V, VI and VII are really a dissertation on sound, treated from a physiological as well as a physical standpoint, not the least interesting part of which is the outline of the modern theory of the functioning of the inner ear—a theory put forward by Harvey Fletcher as more in accordance with scientific facts than the earlier theory of Helmholtz.

In the chapter on voice currents the simple theory of alternating currents is outlined, and the usual "lead" and "lag" expressions are given, along with their representation by rotating vectors. Numerical examples are furnished to illustrate the application of the expressions to concrete cases.

Chapter IX, on the theory of the vacuum tube, will be of particular interest in view of its application to modern wireless work—work which may truly be said to date from Lee de Forest's addition of the grid to Prof. Fleming's original "oscillation wave"; and, although four- and five-electrode valves are in use at the present time, the author is of opinion that the full possibilities of the latter type have probably not been realised. It is a noteworthy indication of the up-to-dateness of the work that the author makes reference to the "wave theory" of atomic structure as furnishing a more satisfactory explanation, if not a proof, than that which has hitherto been associated with the conception of protons and electrons as discrete particles.

The remainder of the book is of a distinctly practical nature, and contains much that will be of interest to the telephone designer, particularly in respect to the magnet steel alloys. On account of the scientific interest attaching to these alloys the author gives a résumé of the important results obtained by Elmen in his investigations of the properties of the iron-nickel-cobalt alloys. In the chapter on coils and electromagnets the usual formulæ are given for calculating the amount of wire required to fill a bobbin of given dimensions, but no expression is given for the calculation of the flux produced in a coil of specified dimensions when a given current is passed through it. The final chapter on joints and contacts will be of particular interest to all those who are concerned, either telegraphically or telephonically, with these items.

The volume is excellently printed, and numerous diagrams are interspersed illustrative of the adjoining text. It will undoubtedly—as the author hopes—help the reader to co-ordinate in his mind the various phases of the industry dealt with in the highly specialised literature now available, and thus assist in giving him the needed perspective.

Alternating Current Electrical Engineering. By W. TOLMÉ MACCALL, M.Sc., M.I.E.E., Head of the Department of Electrical Engineering in the Technical College, Sunderland. Second edition. Pp. viii+496; figs. 372. London: The University Tutorial Press. Price 15s. net.

The volume under notice is the second edition of this well-known book, and advantage has been taken of the opportunity afforded by its issue to bring the descriptive matter and the

nomenclature up to date. In view of the many changes recommended recently, the question of nomenclature has become of considerable importance, and the author has, in general, adopted the suggestions contained in the Standard Glossary issued by the British Engineering Standards Association. There are, however, a few exceptions to be seen, notably in the spelling of the words "converter" and "arrester," while the contraction "c.c." is used in preference to the more usual "d.c."

The volume is intended to serve as a text book on alternating-current work in connection with full-time day courses extending over several sessions and also in connection with advanced evening courses. It is very comprehensive in character, and, in addition to the usual material on circuits and alternating current machines, it contains sections on instruments, transmission lines, and thermionic principles. Many text books on alternating-current work are prone to concentrate on the consideration of the effects of sinusoidal currents and voltages, to the exclusion of the consideration of effects due to the presence of harmonics; this is not the case with the book under notice, and one of the most pleasing sections is that devoted to a consideration of harmonic analysis and other problems introducing the effects of the presence of harmonics.

In a book containing information on such a wide range of subjects it is obviously not possible to enter very deeply into every individual problem, and readers may wish, in certain cases, to have just a little more information than it has been found possible to give in the available space. An instance of this occurs in connection with the calculation of currents and voltages in transmission lines. It is pointed out that the inductance and capacitance are distributed uniformly over the line, and if this fact is taken into account it obviously considerably complicates the calculation. In the worked examples, calculations are made on the basis of neglecting the capacitance and, alternatively, assuming the capacitance to be concentrated at the centre of the line, and it is shown that in lines of considerable length the capacitance exerts a moderate but quite appreciable effect on the magnitudes of the generator current and line drop. Many readers would probably be interested as to the further modification of the results which would be obtained if the refinement of allowing for the distribution of inductance and capacitance had been undertaken. Without necessarily working out the more complicated calculation involved, it would seem to be well worth while pointing out that on lines of such lengths as are likely to be found in this country the modification would be small, and that for practical purposes, while it may be necessary to take the capacitance of the line into account, it will suffice to assume that it is concentrated at, say, the centre of the line.

Few subjects of importance coming within the scope of the book fail to be considered, though probably it would be desirable to include some information concerning the use of external automatic regulators in connection with alternators. Again, in view of the fact that the book is recommended for use in preparing for the alternating-current requirements of the papers in electrical technology set by the University of London, it would appear that some account of the use of complex quantities should be included. It is a most valuable method of attack in many alternating current problems and is worthy of more attention than is commonly given to it in text books.

A considerable number of examples and questions are given at the end of each chapter, and answers are included to those of a numerical nature. The book is clearly printed and the diagrams are clearly and accurately drawn, though a mistake in the lettering is noticeable in the figure on page 378. The book can be heartily commended to those in attendance at Universities and Technical Colleges, whether taking full-time or part-time courses, as being both comprehensive and accurate.

The Electric and Magnetic Circuits: A.C. and D.C. By E. N PINK, B.Sc., A.M.I.E.E. Pp. vii+124; figs. 60. London: Sir Isaac Pitman & Sons. Price 3s. 6d.

The value of a book does not always lie in the facts and theories which it presents, but in their method of presentation. There is often great value attaching to a new view-point, and many of the subjects dealt with in electricity and magnetism are still capable of yielding surprising results when viewed from an angle differing from the customary line of vision.

The little treatise before us cannot be said to contain any new facts or theories, but Mr. Pink has taken a route through what has sometimes seemed to be the desert places of electrical and magnetic theory and has certainly succeeded in opening up new views of the old and familiar landscape. In so doing he has achieved what he hopes in his preface, namely, that "in making the study of this part of the subject easier and pleasanter, both time and effort will be released for the deeper study of other parts of the subject."

Mr. Pink has not attempted in the compass of a little over one hundred pages to deal with every problem arising in electric and magnetic circuits, but he has taken sufficient to give a very clear and enlightening survey of the whole subject. The student who has mastered this little book will have in his possession the methods by which all such problems can be tackled, and our chief criticism is that the author has not followed up the few well-chosen worked examples in the text by appending some more difficult examples at the end of each chapter. This book undoubtedly puts into the hands of the electrical student the tools with which to operate upon the many problems confronting him, but it would have been better still had it given him some difficult jobs to tackle with those tools. Some commonplace problems in power-factor correction are suggested as a suitable addition to the chapters on vector diagrams and condensers and capacity; similar practical problems could be found to illustrate almost every chapter of the book.

Very commendably, we think, a very considerable part of the book is given up to a treatment of the magnetic circuit and the magnetic properties of materials. There is a time-honoured conception that so long as our knowledge of electrical properties are accurate and trustworthy our knowledge of magnetic properties can with safety be left in a very hazy and nebulous condition. Even designers of electrical machinery have been known to suffer from this strange notion. Mr. Pink's book will help to prevent the spread of this doctrine among the rising generation.

This book is such a satisfactory treatment of the subject and its price is so small as to justify the suggestion that it should be studied by all serious students of electrical engineering.

P.H.S.K.

Correspondence.

Correspondents should forward their communications as early as possible. No letter can be published unless we have the writer's name and address in our possession.

Wages in the Electrical Contracting Industry.

I would like to be allowed to invite a word or two of editorial comment on the following matter:—

A few day ago I—doubtless together with many others who employ electricians and wiremen—received a circular intimating that a recommendation of the executives of the N.F.E.A. and the E.T.U., involving a new method of calculating the cost of living, &c., had been accepted, with the result that a rise of some 3s. per week on account of the increase in cost of living was due to the wiremen in the district in which I reside, and which I am invited to pay. For many years I have paid the standard district rates, but on this occasion I shall *not*. This rise, I gather, is based on the average cost of living figures for the last three years. Why three years—and not, say, nine—were taken does not appear, for the longer period would doubtless show that the wiremen would be now entitled to perhaps a 6s. rise!

As a device for keeping up the rate of wages and profits at a time when work is scarce and when the cost of living generally is falling with a mighty wallop, this scheme will take a lot of beating, but as a means for rooking the public, it is, I consider, a disgrace to all who agreed to it. Talk about the electrical wiring industry endeavouring to reduce costs and to increase production, and so on . . . well, Sir, the whole idea is too silly for words!

Hadsum.

January 3rd, 1931.

[This matter is referred to in a "leaderette" this week.—EDS. ELEC. REV.]

Careers for Young Engineers.

Might I be permitted to say a few words in reply to "Pater's" letter in your issue of December 26th which are really intended for his son? Leaving school at the age of 14, I had by then fully decided that I would be an electrical engineer. My father was dead, and in those days I did not realise the significance of "influence"; instead I dived into the first place I saw bearing that mystic sign "Electrical Engineers." I got a start as stores boy; later on I discovered my mistake. Before proceeding any further, let me emphasise the fact that the boys of my time, with very few exceptions, held definite views on which profession or trade they intended to follow, also which particular star in the heavens they would endeavour to reach. There are so many highly important and specialised branches of the trade offering unlimited scope in experimental work, theoretical and practical; for instance, take the follow-

ing: electric propulsion of ships, wireless and direction finding, power stations and railway electrification. It is to-day impossible for a man to be expert in all branches; more than ever is it the day of the *practical specialist*. May I, then, suggest that you consider the merits of the various branches together, decide which one you really think you will make your mark in, then pick on the best firms in that line, and if possible get acquainted personally with some of the directorate or get an introduction and do your best to let them see that you want a job and that you are fully prepared to work and not talk! Vacancies are few, but let your disappointments spur you on to try again. If your work is in the vicinity of a technical college lose no time in joining it. The "plums" are for the man who combines theory with practice. One point I would stress, the man who decides to study by correspondence must, in common parlance, have "guts" to work out his own problems; he has no teacher at his beck and call to whom he can refer every time he comes across a snag, as in a class. This, by the way, provides a splendid grounding in that virtue called patience and its twin perseverance. He must also religiously study two hours per night if he wants to get anywhere, leaving pleasure for the week-ends.

Casey.

December 31st, 1930.

[This letter has been abridged.—EDS. ELEC. REV.]

A Note on Electrical Theory.

I think that no useful purpose would be served by a detailed reply to the points raised by Mr. Starr in your issue of January 2nd.

It seems that my omission of certain names is the chief subject of Mr. Starr's complaint. I explained in my paper that the treatment was necessarily "of a very cursory nature, and must be regarded as the merest introduction to the subject."

Although my brevity seems to have occasioned Mr. Starr's displeasure, I really must decline his suggestion that the work of A. A. Campbell and K. W. Wagner could have been mentioned to any useful purpose in the nine lines he so kindly allocates.

If Mr. Starr will glance at the three pages of bibliography to my paper on "Early Developments in A.C. Circuit Theory" in the *Philosophical Magazine* for November, 1930, he will see that I am under no misapprehension on the points which he has raised.

G. Windred.

Bedford, *January 2nd*, 1931.

Change-overs and Wireless Sets.

It has come to my notice on a number of occasions that supply authorities are deliberately discouraging the sale of electrical apparatus, such as radio sets, d.c. energised loud-speakers, h.t. supply units, and similar components which are not suitable for use on both d.c. and a.c. systems, by informing dealers and their customers that, in the event of their purchasing such apparatus suitable for use on the supply authorities' d.c. mains no compensation of any kind will be made when the change-over to a.c. takes place.

This attitude may be justified if the change-over is imminent, but in many cases such action is being taken when the change-over will not take effect for a long time. In consequence, consumers situated on d.c. supply systems are unable to take anything like full advantage of the facilities provided by electricity, the sale of electricity itself is reduced, and—what is perhaps more serious—the sale of electrical apparatus and the popularising of electricity for domestic purposes is hindered.

This state of affairs exists throughout the country, and it would be interesting to know whether supply authorities have definite local powers of the kind indicated, or whether they are merely holding out threats to avoid charges for which they should be liable when change-overs take place.

J. Baggs.

Manchester, *January 2nd*, 1931.

[This subject is referred to in our leading columns.—EDS. ELEC. REV.]

Prevention of Accidents.

As the author of the above article, I feel that I should make some reply to Mr. Boothroyd's letters, although these appear up to the present to be pointless.

Everyone will agree that far too much apparatus of the simpler kind is sold, mainly by primarily non-electrical firms, without any sort of provision against the possibility of accident. Everyone will also agree that the education of the public, however desirable, is hardly practicable, as even if the instructive matter be published outside the technical Press, as suggested by Mr. Boothroyd, we have then to make the average citizen read it. In any case, the probable effect would be to cause a serious slump in the sale of electrical apparatus and energy.

In the course of my article I developed the theory that the public should be protected in spite of themselves, as children handle so much electrical apparatus in these days, and further came to the conclusion that the generally accepted methods in use in this country were not capable of affording the necessary degree of protection. But Mr. Boothroyd is content merely to reiterate that his method is effective (although it is only earthing after all, and a method that we have all used time and again) and he does not attempt to demolish any single one of my arguments against earthing, which apply equally well to his method of protection.

All electrical engineers agree to-day that the protection of apparatus-users in rural installations is a pressing problem, and Mr. Boothroyd's method applied to the country house or farm without a main water supply might well have disastrous results. How the importation of a Continental method that *will* afford protection can be considered unpatriotic I am at a complete loss to understand, especially if by this means only one English accident may be avoided.

If Mr. Boothroyd will refer to the discussion on the American Grounding Regulations at the recent World Power Conference, he will find it stated that the grounding resistance to be expected in country districts in America (and therefore presumably in this country also) is from 25 to 30 ohms, under good conditions. Simple calculations will show that with a supply voltage of 230 volts, an earth-fault current cannot exceed 8 or 9 amperes, insufficient to blow a fuse protecting a circuit on which portable apparatus might be expected to be connected. I should like Mr. Boothroyd to explain to us how this method will help us in this case, and how protective connection to internal piping will prevent the full-line voltage above earth being present upon the protected apparatus *and* all the piping throughout the building.

Referring again to the lighter apparatus mentioned by Mr. Boothroyd, take one of the most useful, the ordinary hair-dryer. Again and again I find these being used in bathrooms and over washbasins, but I cannot agree that earthing by ordinary methods can be of any lasting benefit here. For instance, constant trouble is experienced with breakdown due to leakages over carbonised hair found in the heating-nozzle, and over the very small insulating bushes holding the brushes, due to the presence of carbon and oil. As soon as the leakage currents reach a value sufficient to blow the protective fuse, enough damage may be done to the apparatus to render it beyond repair. In one case that I know of, a hairdressing establishment, all protective wires were removed from the lighter apparatus at the manager's urgent request, under threat to discontinue the use of this apparatus and to dispense with our services.

With the system of protection that I described, the utilisation of the "Sbik" switch, the leakage current cannot exceed 15 milliamperes, too small a current to cause any sort of damage to light apparatus; also the unwanted potential upon the protected apparatus cannot exceed 42 volts, which is equally true for the rural installation as for all others.

I must apologise for the length of this letter, but the question is of such grave importance as to warrant the fullest discussion. If earthing can be the complete protection that Mr. Boothroyd holds, how comes it that so large a body of opinion is growing against it, or that it should be the subject of so many investigations by independent research bodies both here and abroad? Its deficiencies have been made manifest by recent extensions of low-pressure supplies to country districts, where the honouring of the earthing regulations in the breach rather than in the observance is necessary as being the lesser of two evils.

In any case, earthing by ordinary methods was useful in many cases all the time that better methods were unknown; now that improved methods are available, it is surely the duty of the electrical industry at least to investigate these, even if it does not immediately adopt them. Obstruction and apathy will not get us anywhere, and the fact that over 60,000 Continental establishments have adopted these improved methods would appear to indicate that there is something in them for even Mr. Boothroyd to interest himself in.

T. C. Gilbert.

Folkestone, *January 3rd*, 1931.

Lt.-Col. Vignoles's Tour: what a Canadian Thinks.

Answering Mr. Ernest E. Sharp's challenge (published under the above heading in the ELECTRICAL REVIEW of November 28th, 1930) to find in Toronto a domestic customer whose consumption for the past twelve months amounted to more than Mr. Sharp's for that same period, which was 30,828 kWh, the Toronto Hydro-Electric System has very kindly discovered for me two domestic consumers who both beat Mr. Sharp's consumption. They are both billed on a 3,000 sq. ft. basis which would be anything from ten to fourteen rooms. The first used 32,510 kWh, costing $302.03, or 0.93c. per kWh; the second used 48,960 kWh, costing $407.40, or 0.83c. per kWh. The difference in cost per kWh between the two bills is mainly due to the fact that the second consumer has a flat-rate water heater which consumed 18,780 kWh (included in his total). Incidentally, this second consumer, using only domestic appliances, approaches Mr. Sharp's Newcastle friend with his yearly consumption of 50,000 kWh.

The rates for residence service, a.c., 25 cycle, 115/230-V. are: monthly service charge 3c. per 100 sq. ft. of floor area (minimum 1,000 sq. ft., maximum 3,000 sq. ft.); monthly consumption charge 2c. per kWh up to the equivalent of 3 kWh per 100 sq. ft. of floor area, 1c. per kWh for all additional consumption; monthly minimum 75c. net; discount 10 per cent. for payment within ten days.

I agree with Mr. Sharp that Great Britain is doing a lot

more in the engineering and allied industries than we in Canada are able to give her credit for. This is not our fault, however, if we don't know. I would suggest that it is the fault of Great Britain due to poor salesmanship and publicity.

Osborne Mitchell.

Toronto, *December 13th*, 1930.

Hire-purchase of Electric Irons.

I have read the letter of Mr. B. T. Hawkins on the subject of "Hire-purchase of Electric Irons," published in your issue of December 26th, 1930, and I suggest that he cannot be interested in the *retail* distribution of electric irons. The hire-purchase of electrical apparatus—yes, by all means when it relates to cleaners, cookers, washers, &c., but trivial things like electric irons tend to put the electrical contracting profession in the category of a "tally-man." If this sort of thing goes on we shall shortly have a wireman get a "brain wave" and supply lamps on hire-purchase. Business men as a whole are unanimous that the coupon system in connection with advertising is an undesirable one, and a corporation giving away electric irons surely comes under the same heading.

C. W. Burden.

January 5th, 1931.

Published Specifications.

Compiled expressly for this journal by a firm of chartered patent agents. The numbers in parentheses are those under which the specification will be printed and abridged, and all subsequent proceedings will be taken.

1929.

11,505. "Electrical driving means." J. E. Adey. October 11th, 1929. (339,349.)

18,002. "Asynchronous electric motors." G. Pedrazzo. June 12th, 1928. (313,501.)

21,136. "Telephonic loud-speakers." Farrand Inductor Corporation. July 9th, 1928 (315,230.)

21,482. "Distant control calculating apparatus particularly applicable for totalisators." B. Hochen and J. H. K. Cox. July 12th, 1929. (333,638.)

23,040. "Electric totalisators." J. H. Broome. July 26th, 1929. (339,591.)

24,155. "Alternating electric current measurement devices." Ferranti, Ltd., and W. Holmes. August 7th, 1929. (339,661.)

24,354. "Ship's telegraphs and the like." Ges. für Elektrische Apparate. August 9th, 1928. (317,058.)

24,578. "Remote indications and supervisory control systems." Standard Telephones and Cables, Ltd., and S. Chapman. August 12th, 1929. (339,643.)

24,723. "Wireless direction-finding systems." Sir A. W. Brown. August 13th, 1929. (339,664.)

24,830. "Vibratory electric regulators." British Thomson-Houston Co., Ltd., and R. D. Parry. August 14th, 1929. (339,665.)

26,633. "Electric signalling systems, particularly adapted for controlling traffic." Siemens and General Electric Railway Signal Co., Ltd., and J. Boot. September 2nd, 1929. (339,594.)

26,806. "Kinematograph television and like projection apparatus." S. Prisner. September 3rd, 1929. (339,644.)

26,923. "Electroacoustic instruments." S. Prisner and E. Wender. September 4th, 1929. (339,596.)

27,002. "Electrically-driven gramophones." V. Powell. May 31st, 1930. (339,613.)

27,200. "Electric battery-charging systems." A. H. Midgley. September 7th, 1929. (Patent of addition not granted.) (339,672.)

27,294. "Method of, and apparatus for, the electro-osmotic purification of liquids." L. Mellersh-Jackson (Siemens-Elektro Osmose Ges.). September 7th, 1929. (339,673.)

27,332. "High-tension electric circuit-breakers." W. W. Triggs (Railway and Industrial Engineering Co.). September 9th, 1929. (339,646.)

27,460. "Holders for electric lamp bowls." J. McGregor. September 10th, 1929. (339,630.)

27,490. "Electric fluid-heating apparatus." R. A. Carleton. September 10th, 1929. (339,649.)

27,518. "Electrically-wound clocks with striking mechanism." Kienzle Uhrenfabriken Akt. Ges. September 18th, 1928. (319,240.)

27,737. "Joints and terminal connections for high-voltage electric cables." A. Reyrolle & Co., Ltd., J. Mirrey, and J. Christie. September 12th, 1929. (339,654.)

27,753. "Piezo-electric devices." E. W. C. Russell. September 12th, 1928. (318,934.)

27,835. "Electric conductors." A. Reyrolle & Co., Ltd., F. Coates, and J. Christie. September 13th, 1929. (339,677.)

27,836. "Electric conductors." A. Reyrolle & Co., Ltd., and N. R. Blanch. September 13th, 1929 (339,678.)

27,921. "Speech transmission." Western Electric Co., Ltd. (Bell Telephone Laboratories, Inc.). September 13th, 1929. (339,685.)

28,471. "Soft-iron electric measuring instruments." S. G. S. Dicker (Naamlooze Vennootschap Philips' Gloeilampenfabrieken). September 19th, 1929. (339,689.)

28,824. "Connections for selective relays for protective systems." Akt. Ges. Brown, Boveri et Cie. September 27th, 1928 (319,740.)

29,051. "Protective systems for mercury-arc rectifiers." British Thomson-Houston & Co., Ltd., and J. C. Read. September 25th, 1929. (339,800.)

29,630. "Thermal cut-outs." Felten & Guilleaume Carlswerk Akt. Ges. September 6th, 1929. (339,705.)

30,373. "Wireless aerial systems." H. L. Kirke. October 7th, 1929. (339,714.)

30,418. "Incandescent cathode X-ray tubes." S. G. S. Dicker (Naamlooze Vennootschap Philips' Gloeilampenfabrieken). October 7th, 1929. (339,715.)

31,324. "Production of electric insulating bodies." Siemens & Halske Akt. Ges. October 17th, 1928. (339,726.)

31,921. "Portable electric lamp." O. T. Banks. October 21st, 1929. (339,729.)

32,064. "Means for locating breaks in electric circuits." W. T. Henley's Telegraph Works Co., Ltd., and J. H. Savage. October 22nd, 1929. (339,731.)

32,134. "Electrical apparatus for maintaining playing fields, football grounds, tennis courts, and the like fit for play under adverse weather conditions." A. Imbery. October 23rd, 1929. (339,732.)

32,251. "Electric water heater." A. Low & Sons, Ltd., and D. W. Low. October 24th, 1929. (339,734.)

33,884. "Electric lighting." J. Lawn. November 7th, 1929. (339,748.)

34,369. "Control apparatus for combined electric lighting and heating or like installations." A. C. Johnson. November 11th, 1929. (Patent of addition not granted.) (339,752.)

34,725. "Radio signalling systems." Telefunken Ges. für Drahtlose Telegraphie. December 17th, 1928. (339,757.)

34,832. "Electric recording meters." Associated Electrical Industries, Ltd. November 14th, 1928. (339,759.)

36,310. "Oil-immersed electrical apparatus." General Electric Co., Ltd., F. J. Keeley, and C. C. Garrard. November 27th, 1929. (339,772.)

36,459. "Rolling-stock and other vehicle wheels." Electro-Mechanical Brake Co., Ltd., and L. A. Catlin. November 28th, 1929. (339,773.)

37,189. "Radiation measurement and/or indication apparatus." Westinghouse Lamp Co. December 24th, 1928. (339,781.)

37,332. "Automatic and traffic signals." F. Page. December 5th, 1929. (339,782.)

37,370. "Telephone systems." J. E. Pollak (Siemens & Halske Akt. Ges.). December 5th, 1929. (339,784.)

37,466. "Polarised electric relays or switches." General Electric Co., Ltd., H. C. Turner, and A. Sherwin. December 6th, 1929. (339,785.)

38,030. "Electric regulating systems." British Thomson-Houston Co., Ltd. December 24th, 1928. (339,791.)

38,490. "Electric surge recorders." Associated Electrical Industries, Ltd. December 14th, 1928. (339,796.)

38,792. "Electric incandescent lamps." Egyesult Izzolampa es Villamossagi Reszvenytarsasag. December 18th, 1928. (339,798.)

38,801. "Manufacture of electrodes of electric batteries." P. Rosenberg. November 28th, 1929. (339,799.)

39,066. "Manufacture of filaments for electric lamps." Westinghouse Lamp Co. December 29th, 1928. (339,803.)

39,084. "Electric cables." Callender's Cable and Construction Co., Ltd., and L. G. Brazier. December 29th, 1929. (339,804.)

39,152. "Electrical metering apparatus." Allgemeine Elektricitäts Ges. December 22nd, 1928. (339,807.)

39,941. "Electric ceiling lights." G. N. Haden & Sons, Ltd., and C. M. Davis. December 31st, 1929. (339,818.)

1930.

343. "Electric accumulators." Soc. Anon. des Etablissements Tecalemit. January 8th, 1929. (Addition to 303,799.) (339,824.)

1,027. "Combined housing and screen for electrical apparatus." Gramophone Co., Ltd., and H. H. V. Stanley. January 10th, 1930. (339,832.)

1,612. "Electric condensers." British Thomson-Houston Co., Ltd. January 16th, 1929. (333,838.)

2,757. "Sparking plugs for internal-combustion engines." Imperial Airways, Ltd., G. E. Woods-Humphery, and H. L. Hall. January 27th, 1930. (339,849.)

2,798. "Means for operating wireless sets from a direct-current source affected by ripples." Telefonaktiebolaget L. M. Ericsson. January 29th, 1929. (339,851.)

3,549. "Wireless receiving apparatus." E. H. Chapman and T. B. Franklin February 3rd, 1930. (339,859.)

3,674. "Burglar alarm." C. E. M. A. Constructions Electro-Mécaniques d'Asnières. February 2nd, 1929. (339,863.)

5,270. "Electric regulating systems." British Thomson-Houston Co., Ltd. February 19th, 1929. (339,880.)

5,281. "Process and apparatus for the production of anodes for the cells of electric dry batteries." W. Schmidt. March 21st, 1929. (339,881.)

5,405. "Pin-type electric insulators." Porzellanfabrik P. Rosenthal and Co. Akt. Ges November 12th, 1929. (339,883.)

6,260. "Illuminating appliances." Holophane, Ltd. (W. A. Dorey). February 25th, 1930. (339,888.)

6,390. "X-ray tubes." British Thomson-Houston Co., Ltd. February 27th, 1929. (339,891.)

8,067. "Single-phase transformers." Associated Electrical Industries, Ltd. March 12th, 1929. (339,902.)

8,687. "Röntgen-tube holder." Siemens-Reiniger-Viefa Ges. für Medizinische Technik. July 17th, 1929. (339,908.)

10,509. "Variable-speed electric gear for driving moving grates and other objects." H. Romer. April 2nd, 1930. (339,915.)

15,331. "Electrical incandescent lamps or the like." General Electric Co., Ltd. May 18th, 1929. (339,927.)

20,682. "Welding electrodes, and methods of manufacturing the same." British Thomson-Houston Co., Ltd. July 8th, 1929. (339,930.)

30,376. "Electric totalisators." J. H. Broome. July 26th, 1929. (Divided application on 339,591.) (339,622.)

32,020. "Telephone systems." Automatic Telephone Manufacturing Co., Ltd., and C. Gilling. September 5th, 1920. (Divided application on 339,345.) (339,600.)

Trade Mark Applications.

THE following are among the latest applications for British trade marks. Objections against any of the proposed marks may be entered within one month from the dates mentioned:—

DECEMBER 24th.

Con-Dial. No. 515,352. Class 8. Combined graduated dials and variable condensers for use in radio-telephony.—Decmark Products, Glynde Road, Crofton Park, S.E.4.

Mycalex. No. 517,061. Class 8. Scientific and philosophical instruments and apparatus for useful purposes. No. 517,063. Class 18. Engineering, architectural, and building contrivances.—Mycalex (Parent) Co., Ltd., Abbey House, Victoria Street, S.W.1.

Stenode (lettering and design). No. 517,962. Class 8. Scientific and philosophical instruments and apparatus for useful purposes.—British Radiostat Corporation, Ltd., Montreal, Canada, and 29, George Street, Hanover Square, W.1.

Elektronome. No. 517,020. Class 10. Electrical clocks and parts thereof.—Gebruder Junghans Gesellschaft, Schramberg, Germany (British representatives: Haseltine, Lake & Co., 28, Southampton Buildings, Chancery Lane, W.C.2.)

Mercut. No. 517,566. Class 13. Electrical cut-outs.—Mercurial Cut-outs, Ltd., Havelock Road, Biggleswade, Beds.

Thyrite. No. 516,438. All goods in Class 13.—British Thomson-Houston Co., Ltd., Crown House, Aldwych, W.C.2.

DECEMBER 31st.

Eltax. No. 509,655. All goods in Class 6.—Die Elektro Gesellschaft, Berlin. (British representatives: Edward Evans & Co., 27, Chancery Lane, W.C.2.)

Duraty. No. 517,135. Class 8. Electric storage batteries (not for medical purposes).—Duraty Accumulator Co., 24, Clifton Road, South Norwood, S.E.25.

Condor. No. 517,449. Class 8. Electric batteries and cells and parts thereof.—India-Rubber, Gutta-Percha & Telegraph Works Co., Ltd. 106, Cannon Street, E.C.4.

Macobond. No. 513,561, and Macomet. No. 513,563. Class 13. Electric contacts and terminals of ordinary metal.—Macintosh Cable Co., Ltd., 32, Osnaburgh Street, N.W.1.

Prestotherm. No. 515,804. Class 18. Electric lighting, cooling, drying, and ventilating plants, and heating and cooling appliances.—Siemens-Schuckertwerke Gesellschaft, Berlin. (British representatives: Haseltine, Lake & Co., 28 Southampton Buildings, Chancery Lane, W.C.)

New Work for Contractors.

Particulars of new works and building schemes for the use of electrical installation contractors in search of work and all interested in the sale of electrical and allied plant and other products.

Publication in this list is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

ARBROATH.—Housing scheme for T.C.; burgh engineer.

BANBURY.—Houses (76), Easington estate; borough engineer.

BARKING.—Houses (900) for the U.D.C.; surveyor. Infectious diseases hospital (£100,000) for the U.D.C.; C. J. Dawson, architect.

BEDFORDSHIRE.—School, Stewartby, for the county E.C.; Oswald P. Milne, architect London.

BIRMINGHAM.—R.C. school, Kings Heath; Father Kelly, parish priest, St. Dunstan's R.C. church.

BLACKPOOL.—Hospital, near Whinney Heys Hall, Stanley Park; board of management, Blackpool Hospital.

BLETCHINGLEY.—Mental hospital (£21,750) for Surrey C.C.; F. J. Hodgson, architect.

BRISTOL.—St. Christopher's Church, Brislington (£12,500); Frank Williams, builder, Temple Back.

BUCKINGHAMSHIRE.—Senior school, Chalfont St. Peter, for the county E.C.; director of education, Aylesbury.

BURNLEY.—Alterations and extensions to Municipal College (£18,000) for the T.C.

CANNOCK.—School, Littleworth, and extensions, Hightown schools (£10,000), for the E.C.; S. Harrison, architect.

CHADWELL HEATH.—Library; Dagenham U.D.C. surveyor.

CHERTSEY.—Mental colony (£440,500); E. C. Harris, 3, Bedford Square, W.C., quantity surveyor.

CHESHIRE.—Schools, Kingsley & Newton, for the county E.C.; F. A. Browne, county architect, Chester.

CHRISTCHURCH.—Kinema, High Street; J. Rowley, 120, Christchurch Road, Bournemouth.

COLNE.—Extension of Reedyford Hospital (£15,000); board of management.

CREWE.—School, Underwood Lane, for the borough E.C.; borough surveyor.

CUDWORTH.—Reconstruction of kinema theatre, Barnsley Road; P. A. Hinchliffe, architect.

DORKING.—Houses (102) for the Workmen's Housing Association.

DOVER.—Houses (100) for the T.C.; borough surveyor.

DUMBARTONSHIRE.—R.C. school, Alexandria (£23,000); clerk of works, Education Authority, Dumbarton.

DURHAM.—Public baths and washhouses (£25,000) for the T.C.; city surveyor. Schools (576 places), New Silksworth, Willington (400 places), West Pelton (£12,250), and Springwell (£12,250), for the county E.C.

ESSEX.—Schools, Laindon and Rayleigh, for the county E.C.; director of education, Chelmsford.

EXETER.—Houses (500) during next five years; city engineer.

GRAVESEND.—Houses (400) for the T.C.; borough surveyor. School (£17,429) for the borough E.C.; A. E. Tong and Son, builders.

HALIFAX.—Houses (1,050) for the T.C.; borough surveyor.

HIGH WYCOMBE.—Houses (1,050) for the T.C.; borough surveyor.

HOLLINWOOD.—Extension of works; Ferranti, Ltd.

HORNCHURCH.—Factory for Standard Switchgear, Ltd.

IRISH FREE STATE (TRIM, CO. MEATH).—Technical school for Vocational Education Committee; Vincent Kelly, architect, 87, Merrion Square, South, Dublin.

KENT.—Central school, Walmer, for the county E.C.

LANARKSHIRE.—Primary schools, Auchinloch (£11,000) and Low-Waters (£21,000); master of works, Hamilton.

LANCASHIRE.—Schools, Fleetwood (300 places) and Rainford (£22,000), for the county E.C.

LIVERPOOL.—Church, Norris Green (£16,000), for the C. of E. Authorities; Bernard A. Miller, 40, Glenmoor Road, Broxton, Birkenhead.

LONDON (KING'S CROSS, N.).—School; rector, Blessed Sacrament R.C. Church.

(CHELSEA, S.W.).—Kinema, King's Road and Riley Street; Associated British Cinemas, Ltd.

(HAMMERSMITH, W.).—Kinema, Queen's Road and Fulham Palace Road; McLaughlin & Harvey, Ltd., contractors.

(KENSINGTON, W.).—Reconstruction of Bolton's Kinema, Drayton Gardens; licensee.

LONG SUTTON (LINCS.).—Bank for the National Provincial Bank, Ltd., London.

MIDDLESBROUGH.—Houses (1,060) for the T.C.; borough surveyor.

MIDLOTHIAN.—School, with electrical work, East Calder, for County Council E.C.; clerk, County Rooms, Edinburgh.

MONMOUTHSHIRE. — Extensions, secondary school, Aberstchan, for the county E.C.

MOTTINGHAM (KENT).—R.C. church, Rev. Canon W. Monk, Bishop's House, St. George' Road, S.E.

NEATH.—Houses (50) for the R.D.C.; surveyor.

NEWARK.—Houses (50), Gilsrap Park estate; borough engineer.

NEWCASTLE.—Houses (2,000); city architect.

NORTHFLEET.—Britannia Metal Works; J. B. Lingham, builder.

NORWICH.—Municipal offices and police buildings (£300,000) for the T.C.; Robert Atkinson, architect, London.

OXFORD.—Postal sorting office, Headington, for H.M. Office of Works, King Charles Street, London, S.W.

PRESTON.—Houses (350) for the T.C.; borough surveyor.

RAMSGATE.—Houses (100) for the T.C.; borough surveyor.

READING.—Secondary and elementary schools for the borough E.C.; director of education.

ROCHESTER.—Houses (400) for the T.C.; city surveyor.

SEDGELEY.—Houses (120) for the U.D.C.; surveyor.

SOUTHEND-ON-SEA.—Mental hospital, Runwell, for Southend and East Ham Corporations; borough surveyor. Station for the L.M.S. Railway Co.; A. J. Arnold, builder, Westcliff.

SURREY.—Schools, Merton and Sutton, for the county E.C.

SUTTON (SURREY).—Bank, High Street, for Lloyd's Bank, Ltd. Houses (114), Elm Park Farm estate, for Braddy and Randall.

SWINDON.—Hospital (£44,000) with central heating and electrical work for the Great Western Railway Medical Fund Society; secretary.

SWINTON.—United Methodist School; trustees, Worsley Road Church.

TAMWORTH.—Houses (102) for the T.C.; borough surveyor.

TROON.—Post Office and telephone exchange; architect, H.M. Office of Works, 122, George Street, Edinburgh.

WALLINGTON & BEDDINGTON.—Houses (68) for the U.D.C.; surveyor.

WALSALL.—Houses (2,000) for the T.C.; borough surveyor.

WEST BROMWICH.—Houses (160); A. D. Greatorex, borough architect, Town Hall.

WEST RIDING.—Schools, Hatfield, Dunscroft (£27,670), Stainforth (£40,650), and Thurcroft, for the county E.C.; director of education, Wakefield.

WEST WICKHAM (KENT).—Church (£14,500); rector.

YARMOUTH.—Houses (850) during next five years; borough engineer.

YEOVIL.—Kinema theatre, Church Street, for A. S. Thring.